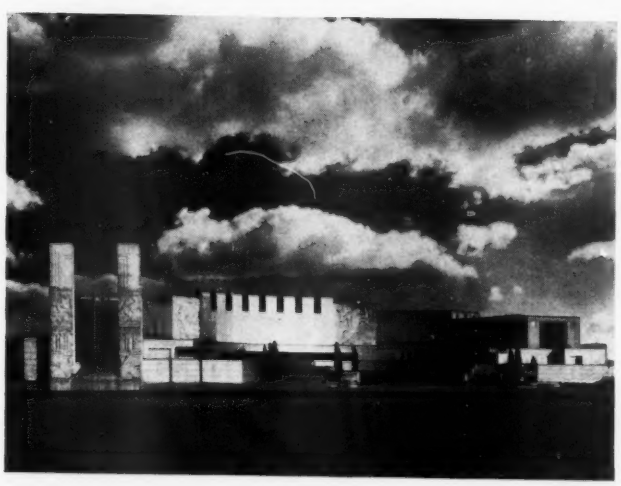
EDISON ELECTRIC INSTITUTE BULLETIN



VOLUME I MAY 1933 NUMBER 2

A Clearance Sale
of
Bound Reference Books

During the period of April 1 to May 31, 1933, the bound publications listed below, originally published by or jointly with the National Electric Light Association, are offered on special sale at a price greatly reduced from the original sale price. By reason of the liquidation of the National Electric Light Association and the necessity for reducing storage space, these books must be moved prior to June 1. A limited supply will be reserved by the Edison Electric Institute for future sale at the original price.

Title	*Original Publication Price to NELA Members*	*Special Sale Price*
Handbook for Electric Metermen, 4 Ed, 1923	$4.00	$1.00
Overhead Systems Reference Book, 1st Ed, 1927	5.00	1.00
Code for Electricity Meters	2.00	.25
Underground Systems Reference Book, 1st Ed, 1931	4.00	1.00
Vol. I, Engineering Report of the Joint Subcommittee on Development and Research	7.50	1.00*
Vol. II, Engineering Report of the Joint Subcommittee on Development and Research	7.50	1.00*
Relay Handbook and 1931 Supplement Bound under one cover complete	4.00	1.00
Relay Handbook and 1931 Supplement Bound separately, these will be supplied if the above item is exhausted	4.00	1.00
Supplement (1931) to Relay Handbook, alone	2.00	.50
Safety Methods in Power System Construction	.75	.25
Proceedings, Annual, of the NELA, 1932 and a very few sets for previous years	10.00	1.00
Speakers Handbook (Revised to 1931)	2.50	.75
Your Health and Your Earning Power — Published 1931 (Cloth binding)	.65	.25

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420 Lexington Avenue, New York

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume 1 MAY, 1933 Number 2

INFORMATION ON THE INSTITUTE'S FIRST CONVENTION

A program that will cover many of the major problems immediately before the electric light and power industry has been developed for the first annual Convention of the Edison Electric Institute, to be held at the Palmer House, Chicago, Monday, June 5 to Thursday, June 8, inclusive.

The business program will be an all-industry one with speakers at the four general sessions confined to membership within the Institute. The diversity and completeness of the program are indicated by some of the subjects to be discussed, which include such matters of general interest as rates, and taxation; such subjects of a commercial and load-building nature as air-conditioning and its various applications, new fields for lighting, commercial competition of the present and future, and an evaluation of the national coordinated promotional programs; and such subjects of an engineering and executive interest as distribution costs, outages, service standards and investment, and developments in power stations.

Prepared discussion of a number of the papers to be presented will be made, in each case by authorities representing different member companies of the Institute.

EXERCISES AT THE EXPOSITION

Wednesday, June 7, has been designated as Electric Day at the Century of Progress Exposition. In appreciation of this compliment, the Institute will hold at 3:30 p.m. a special session on the promenade of the second floor of the Electrical Building when brief addresses will be made by President Cortelyou in behalf of the Institute, by Mr. Rufus C. Dawes, President of the Exposition, and perhaps by Mayor Kelly, of the City of Chicago. It is hoped that all delegates and guests to the Convention will attend these exercises, which will precede a general inspection of the electrical and scientific exhibits housed in the buildings of the electrical group.

FIRST SESSION

The first session of the Convention will be opened by President Cortelyou, whose address will be devoted mainly to the affairs of the Institute, particularly as regards its policies and its future plans. Reports to the Convention will also be made by Mr. Edward Reynolds, Jr., Treasurer, and Mr. Bernard F. Weadock, Vice-President and Executive Secretary.

A most timely subject for an address has been chosen by Mr. Alex Dow, member of the Board of Trustees of the Institute and President of the Detroit Edison Company, who will talk on how to get along these days. After Mr. Dow's speech, a paper on distribution costs will be presented by Mr. Norman R. Gibson, Vice-President and Chief Engineer of the Buffalo, Niagara and Eastern Power Corporation, and this paper will be followed by prepared discussions by Messrs. P. M. Downing, Vice-President and General Manager, Pacific Gas & Electric Company; H. W. Fuller, Vice-President, Byllesby Engineering & Management Corporation, and H. B. Gear, Assistant to Vice-President, Commonwealth Edison Company.

Mr. E. W. Lloyd, Chairman of the Convention Committee and Vice-President of the Commonwealth Edison Company, will welcome the Convention to Chicago and discuss the Century of Progress Exposition, together with the electrical exhibits at the Exposition, which will be of a magnitude and completeness never reached before.

This session, as well as the others, will be held in the Grand Ballroom of the Palmer House. It will convene at 10 a.m. Monday, June 5, and continue until 1 p.m.

SECOND SESSION

The second session, to be held on Tuesday, June 6, will begin with a paper on outages, service standards and investment, to be presented by Mr. S. M. Dean, The Detroit Edison Company. Discussion of Mr. Dean's paper will be participated in by Messrs. B. L. Huff, Commonwealth & Southern Corporation, H. W. Eales, Byllesby Engineering & Management Corporation, and others. Developments and trends in steam power stations is the subject of a paper to be presented by Mr. F. S. Clark, Stone and Webster Engineering Corporation. Discussion of Mr. Clark's paper will be made by a number of engineering executives from different sections of the country.

Mr. James E. Davidson, Chairman of the Electric Refrigeration Bureau, and President of the Nebraska Power Company, will make an evaluation of our national coordinated promotional programs, which will be followed by a talk on the program of the National Electric Cookery Council, by Mr. P. S. Arkwright, Chairman of the Council, and President of the Georgia Power Company.

THIRD SESSION

The program for the third session, to be held Wednesday from 10 a.m. until 1 p.m. will be devoted exclusively to commercial subjects. The first paper will be on load building opportunities in the air conditioning field. It will be presented by Mr. C. E. Michel, Merchandising Manager of the Union Electric Light and Power Company, St. Louis, and followed by discussion on practical applications of air conditioning. Discussion on industrial applications will be led by Mr. R. H. Tillman, Consolidated

Gas, Electric Light and Power Company, Baltimore; discussion on commercial and residential applications led by Mr. Davis M. DeBard, Stone & Webster Service Corporation, New York; general discussion will be led by Mr. W. H. Hodge, Byllesby Engineering and Management Company, Chicago.

Mr. M. E. Skinner, Assistant Vice-President, Niagara Hudson Power Corporation, Buffalo, will make a survey of new fields for promotion of lighting sales. Mr. Skinner's address will be supplemented by visual demonstrations of new lighting sales methods. Discussion of Mr. Skinner's address will be led by Mr. H. M. Sawyer, American Gas and Electric Company, New York, who will amplify the commercial and industrial aspects; by Mr. R. E. Fisher, Pacific Gas and Electric Company, San Francisco, who will consider the residence and rural applications; and by Mr. Oliver Hogue, Commonwealth Edison Company, Chicago, who will lead the general discussion.

An amusing skit on "How Not to Sell" will provide an interlude, and the session will close with an address on commercialism and competition of today and tomorrow, by the Chairman of the Sales Committee, Mr. George E. Whitwell, Vice-President, Philadelphia Electric Company.

FOURTH SESSION

An important paper on the trend of rates will be presented at the fourth session by Mr. F. A. Newton, The Commonwealth & Southern Corporation. Discussion of this paper will be led by Mr. William J. Hagenah, Standard Gas and Electric Company, and Colonel William Kelly, Buffalo, Niagara & Eastern Power Corporation.

Mr. W. C. Mullendore, Executive Vice-President, Southern California Edison Company, Ltd., will have taxation as the subject of an address and Mr. Bernard F. Weadock, Vice-President and Executive Secretary of the Institute will talk on the Federal Trade Investigation of public utilities.

This session will also be devoted to discussion and action on such general business of the Institute as may come before the Convention.

SPECIAL MEETINGS

In addition to the four scheduled general sessions and the exercises in the Electrical Building on Wednesday afternoon, special meetings will be held by a number of the committees of the Institute. These meetings will be as follows: Electrical Equipment Committee, Palmer House, 10 a.m., June 4; Power Generation Committee, Palmer House, 2 p.m., June 4; Transmission and Distribution Committee, Palmer House, 2 p.m., June 5; Sales Committee, Palmer House, 3 p.m., June 5.

GENERAL INFORMATION

Convention headquarters will be located at the Palmer House, State and Monroe Streets and Wabash Avenue, and the general sessions will be held each morning in the Grand Ballroom on the fourth floor of the hotel.

The general sessions will convene promptly at 10 a.m. Daylight Saving Time and adjourn at 1 p.m.

Registration and railway ticket validating offices will be on the same floor and adjacent to the Ballroom. There will be no registration fees for the Convention. Although no formal invitations have been extended, the meetings will be open to general attendance, and it is hoped that those interested in industry matters, whether members of the Institute or not, will avail themselves of the opportunity to attend the meetings. Programs and Convention badges will be distributed at the Registration Desk.

No entertainment program has been planned since it was thought that out-of-town delegates and their families would wish to spend as much time as possible at the Century of Progress Exposition. It was partly for this reason that no general sessions were scheduled for afternoons and evenings of the Convention period. There will be a general admission fee of 50 cents for adults, and 25 cents for children, charged for admission to the Exposition Grounds, but admission to the electrical group, and a number of other buildings will be free.

HOTELS

A circular giving rates and locations of the principal Chicago hotels, together with a reservation blank has been sent to all members of the Institute. Reservations should be sent to Mr. William A. Durgin, Chairman of the Hotel Committee, who will arrange with the hotel selected for the required reservations. It is desirable that all who plan to attend the Convention send in their reservations promptly, both to insure adequate accommodations and to facilitate the work of the Exhibition Committee.

TRANSPORTATION

On account of the Century of Progress Exposition, round trip railroad fares to Chicago from practically all points in the United States will be substantially reduced during the summer. For this reason, it has been unnecessary for the Institute to distribute the certificates authorizing reduced convention fares, usually issued by transportation companies. As an example of the low rates to be in effect, railroads operating between New York City and Chicago are offering special round trip tickets from New York for $33.00. These tickets for the trip to Chicago are good on Saturdays only and have a ten day limit. They are valid for returning on any date within the limit.

ANTON G. HODENPYL

Anton G. Hodenpyl, for many years prominent in public utility circles, died at Richmond, Va., on April 23rd.

Mr. Hodenpyl was born at Grand Rapids, Mich., on November 7, 1852. In 1888 he organized the Michigan Trust Company at Grand Rapids and served as secretary and vice-president of that company until 1901, when he came to New York as a member of the firm of King, Hodenpyl & Co., Brokers, 7 Wall St. and Chicago, and also as a member of the firm of Hodenpyl, Walbridge & Co., which latter firm became Hodenpyl, Hardy & Company on January 1, 1911.

Mr. Hodenpyl had been president of the Commonwealth Power, Railway and Light Company, Michigan Light Company, Union Railway, Gas and Electric Company, Evansville Light Company, Peoria Light Company and Springfield (Ill.) Railway and Light Company. Most of these companies have been merged into the present Commonwealth and Southern Corporation.

In recent years Mr. Hodenpyl had restricted his business activities but he was still a director in the J. G. White Engineering Corporation, J. G. White & Co., Inc., Matinecock Bank of Locust Valley and Piping Rock Water Company.

ART EXPOSITION

While the Chicago Art Institute is not within the Exposition grounds, it is nearby and the Exposition authorities have received the cooperation of the Art Institute in housing within its building a large collection of famous paintings, sculpture and other examples of art collected from the great cultural centers of the world. An admission fee will be charged to this exhibit, but Mr. E. W. Lloyd has advised that in case a group of delegates wish to see the art exhibit, special rates may be obtained.

THE COVER

This month's cover shows a new view of the main building of the Electric group at the Chicago Exposition.

APRIL MEETING OF THE OPERATING COMMITTEE

Other Notes on Institute Activities

The Operating Committee of the Institute held a meeting at the general office in New York on April 26 at which time the recommendations of the chairmen of the several technical committees as regards the personnel of the committees were approved, the program for the June Convention was considered and interpretations and decisions were made on a number of important administration matters, these actions being subsequently endorsed by the Board of Trustees. Of the decisions made at this meeting one related to the establishment of an annual subscription price of $2. in the United States, and $3. in foreign countries for the EDISON ELECTRIC INSTITUTE BULLETIN, which will be open to subscriptions from both members and non-members, while another provided for the disposition of approximately twenty unpublished reports, prepared by committees of the National Electric Light Association during the last months of its existence and turned over to the Institute by the Liquidating Committee of the N.E.L.A. Two of these reports appear in this issue of the BULLETIN and others will appear in later numbers, while still others will be printed as separate reports. These latter include a report on home air conditioning and reports of the Prime Movers Committee on turbines, station piping, pulverized fuel, stoker equipment and furnaces, power station chemistry, and burning of liquid and gaseous fuels.

TECHNICAL COMMITTEE APPOINTMENTS

The regulations regarding appointments to the technical committees, as formulated by the Operating Committee, provide that initial appointments shall be for the period ending June 30, 1934; that officers and employees of non-member companies are not eligible for appointment to committees; that members of committees are not required to be individual members of the Institute, but must be employed by member companies. It is also required that nominations to membership on technical committees shall be approved prior to appointments by the senior executives of the company concerned, and that, in general, not more than one member shall be appointed to a committee from one member company.

The number of individuals to serve on the several committees, as recommended by committee chairmen and approved by the Operating Committee, are as follows:

PRIZE AWARDS COMMITTEE—The Chairman, the President of the Edison Electric Institute, and a third member to be selected.

RATE RESEARCH COMMITTEE—Nine members, including the Chairman.

STATISTICAL COMMITTEE—Eight members, including the Chairman.

ACCOUNTING COMMITTEE—Twelve members, including the Chairman. It was agreed that if the Chairman of the Committee found it desirable the Committee might be enlarged to sixteen members.

POWER GENERATION COMMITTEE—Twenty-six members, including the Chairman.

TRANSMISSION AND DISTRIBUTION COMMITTEE—Eighteen members, including the Chairman.

ELECTRICAL EQUIPMENT COMMITTEE—Sixteen members, including the Chairman. A subcommittee to be composed of meter specialists will also be provided for.

SALES COMMITTEE—Twenty-seven members, including the Chairman. In addition six subcommittees of six to ten members each will be set up. The Chairmen of the subcommittees will be members of the main committee, but the balance of the subcommittee personnel will be selected from men not members of the main committee but who are especially qualified to deal with the subjects to be studied by the subcommittee.

INSURANCE COMMITTEE—Action has not yet been taken on the personnel of this committee.

CODES AND STANDARDS SUBCOMMITTEE (a subcommittee of the Operating Committee)—Three members, including the Chairman.

PROPOSED COOPERATIVE MARKETING PLAN

A committee consisting of Messrs. H. P. Liversidge, Chairman; J. E. Davidson, E. W. Lloyd, A. H. Schoellkopf and G. H. Clifford was appointed by the Operating Committee to consider a proposal for the development of a Cooperative Marketing Plan of national scope and to confer with such committees as may be appointed by the National Electrical Manufacturers Association, the National Electrical Contractors Association and the National Electrical Wholesalers Association in regard to this proposal.

INDIVIDUAL MEMBERSHIPS

Further consideration is being given to the question of individual memberships as provided for in the Constitution. A number of such applications have already been received but action thereon will be held in abeyance pending a further decision which may be reached at the June Convention or shortly thereafter.

PROPOSED AFFILIATION WITH C.E.A.

Negotiations toward an affiliation with the Canadian Electric Association are now in progress. A committee consisting of Messrs. B. C. Cobb, B. F. Weadock and President Cortelyou has already held a conference with a committee consisting of Messrs. J. S. Parker and R. P. Beaumont, representing the Canadian organization, at which tentative agreements were reached providing for company membership by members of the Canadian Association through payment of a group fee by the C.E.A.

ATTENDANCE AT MEETING

Members of the Operating Committee attending the April meeting were: Messrs. George B. Cortelyou, Chairman, A. H. Kehoe, P. S. Young, B. F. Weadock, Edward Reynolds, Jr., G. H. Clifford, J. E. Davidson, Sidney Hosmer, T. A. Kenney, H. P. Liversidge, E. W. Lloyd, J. F. Owens and A. H. Schoellkopf, and by invitation: Messrs. H. S. Bennion, J. A. Johnson, J. H. Lobban, A. Maxwell, F. A. Newton, A. E. Silver and G. E. Whitwell.

MEMBERSHIP IN THE INSTITUTE

The list of company members of the Edison Electric Institute continues to grow. Including the latest elections to membership the operating company members now represent over 75 per cent of the electricity generated in the United States by public utility companies.

IMPORTANT TESTIMONY ON THREE PER CENT TAX

Important testimony relating to the 3 per cent tax on electrical energy was given on May 2 at Washington by Mr. William J. Hagenah, Vice-President of the Edison Electric Institute, when, on behalf of the Institute he appeared before the Committee on Finance of the United States Senate during the committee's hearings on H.R. 5040. ("An act to extend the gasoline tax for one year, to modify postage rates on mail matter, and for other purposes." This bill provides for the transfer of the present electrical energy tax from consumers to the producers.)

Mr. Hagenah brought out in his testimony that the annual tax burden of the electric light and power companies, as the result of the mounting property, sales, and franchise taxes imposed by the

(*Continued on page 50*)

A realistic demonstration of electricity at work is given in the world's largest diorama, pictured above, a ninety-foot plastic

THE ELECTRICAL EXHIBITS AT THE

Although Chicago's Century of Progress Exposition will have been in full swing for a week when the Edison Electric Institute Convention opens in Chicago on June 5, the date of the formal opening and dedication of the buildings of the electrical group has been deferred until "Electric Day," June 7, in order that the Institute may officially take part in the ceremonies, in which leaders of the public utility industry from throughout the United States will participate. The Institute's part in the dedication ceremonies will take place at 3:30 p.m. on the 7th, when brief addresses will be made by President Cortelyou, by Mr. Rufus F. Dawes, President of the Exposition, and by Mayor Kelly of Chicago.

"Electricity at Work" is the name that has been given to the Central Station Industry Exhibit, which will occupy 8000 square feet of floor space in the main building of the Electrical group. The gigantic diorama portraying in miniature the production and distribution of electricity will be the central feature of this exhibit, and, without doubt, one of the most interesting displays of the entire Exposition.

In addition to the diorama, there will be shown in the industry's exhibition model farms, stores, factories, offices, school rooms, hospital operating rooms, beauty parlors, shops, household interiors, gardens, and another smaller diorama giving realistic vision of advanced and efficient methods of electric illuminating —also there will be many full size rooms and workshops equipped with electrical appliances and lighting effects heretofore unknown to the majority of the people. Mr. E. W. Lloyd, vice-president of the Commonwealth Edison Company is chairman of the Industry's Exhibit Committee.

A large and comprehensive exhibit that will show products of numerous manufacturers of production, transmission, distribution and utilization equipment will also be housed in the buildings of the Electrical group. In many cases the displays will represent the most extensive showings yet attempted by manufacturers of electrical equipment.

The Electrical group is located on Northerly Island in the Exposition grounds and consists of three buildings with connecting sections. One of the approaches from the mainland is via a bridge from the Hall of Science spanning a lagoon thirty feet above the water level and symbolically bridging the gap between engineering and science.

The group stretches for nearly a quarter of a mile along the island, reflecting in the waters of the lagoon, its brilliant white, yellow and red exterior accented with gold, blue and silver.

The dominant feature of the sculptural decoration of this group are bas relief panels fifty feet square which delineate man's struggle to wrest power from nature. Between these panels will be an entirely new and striking effect, obtained electrically, in brilliant colors harmonizing with the pigmentation on the building.

Inscribed under the heroic figure, representing Light, are the words:

"Light is the beginning of all Things. From the utmost ether it issues shaping the stars, answering in its patterns to the majesty of creative thought."

Under the other powerfully-sculptured figure, symbolizing Energy, is written:

"Energy is the substance of all things —the cycles of the atoms, the play of the elements are in forms cast as by a mighty hand to become the world's foundations."

The marvels of electricity, particularly in the field of illumination, by no means will be confined to buildings of the Electrical group. Unlike most expositions of the past, both in this country and abroad, where the buildings have been of stuccoed surfaces, with little color and paint illumination, the Century of Progress Exposition will be a symphony of brilliant light and color.

The official "Book of the Fair" states that "Incandescent bulbs, and neon tubes, the former by the millions, the latter by the mile, will be used alone and combined to make three and one-half miles of the most gala and extraordinary shower of light ever displayed. There will be concealed lights bringing out mysteriously shaped silhouettes in the background and yet giving plenty of illumination on the paths, and festive decorations in brilliant color during the day will become banners of light at night. The two towers of the Skyride, each six hundred feet high and two thousand feet distant, will rise at opposite points on the mainland and island, and appear as phantoms in the clouds, while swinging across from one tower to the other at a height of two hundred and fifty feet will be the observation cars, flashing like meteors in the sky. A multicolored cascade of water, stretching around the entire shores of the two lagoons, two miles in perimeter, will give the effect, when seen from the water or the opposite shore, of an enchanted city floating like a cloud on a bed of light. The buildings themselves will be jewels set in this necklace of brilliance, and offer scintillating and spectacular compositions wherever the

picture which will form the central portion of the exhibit of the electric light and power industry at the Chicago Exposition.

CENTURY OF PROGRESS EXPOSITION

eye may rest. Finally, sweeping the skies and stretching out over the wide expanse of Lake Michigan will move the ever restless searchlights, piercing the heavens and proclaiming to the whole world that here one truly sees the apotheosis of light."

A vivid description of the diorama mentioned previously was given in a recent issue of the Chicago *Tribune*. The author of the article was present at an informal preview of the diorama on May 6, and wrote in part:

"The drama of electricity from its generation amid bleak mountain crags to its utilization in a modernistic city was revealed last night in a heroic diorama that will be one of the supreme spectacular features of the World's Fair.

"The work of one hundred and ten artists and artisans who have been toiling for eight months on this animated picture was crowned at 9 o'clock when Miss Barbara Graf, daughter of Robert J. Graf, vice-president of the Byllesby Corporation, poured into the diorama's low-head hydro-electric station a pitcher of water from the site of the first hydro-electric station built in the United States, just half a century ago.

"Instantly the 95 foot tableau broke into light and movement. Reservoirs in mountain fastnesses sparkled with sudden fire. The drama of light and movement flung itself upon the dark plains for below the crags, and the turbines in open cross-section models of hydro-electric stations began to turn.

"Swiftly the drama marched across pastoral to industrial America. Electrically equipped ranches where cattle graze, and electrically equipped quarries and steel mills were disclosed. Transmission towers sentineled the valleys and the plains. Cranes were swinging against the horizon.

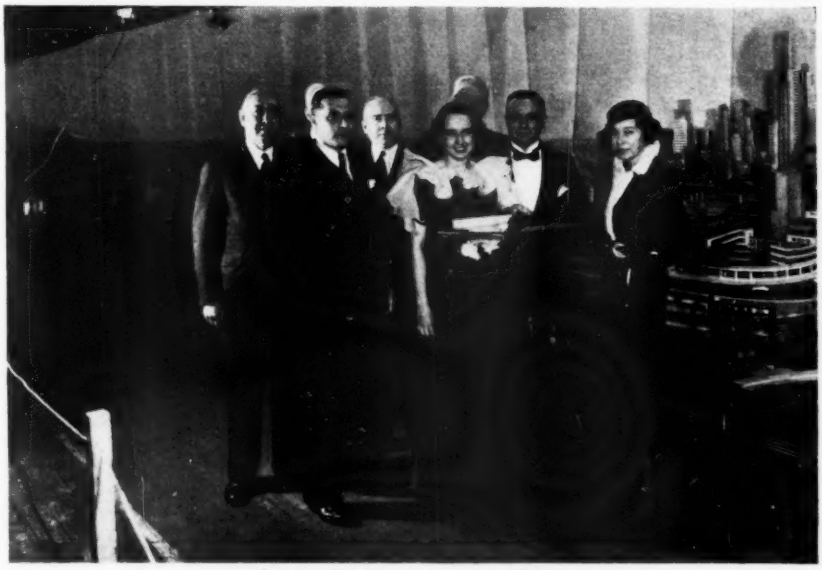
"The twinkling lights crossed green stretches of woodland to cozy model farms where electricity had taken the weariness and dreariness out of toil. Light glided into the suburbs of a great city, searching out the dustless circumference of the interiors of circular apartment houses, all the outer walls of which were of glass. It touched with a mellow glow the church towers, theaters, skyscrapers, gleaming subways, and elevated highways of what the voice of a concealed lecturer was calling 'a modernistic Utopia—a model city of a quarter of a century hence.'

"'Who knows?' mused the voice. 'Perhaps we shall achieve it far sooner, for the story of the distribution and utilization of electricity is little more than a half a century old.'

"The pageant of light moved across the city, revealing the workings of a steam electric-generating station with switch yards leading into it. Trains were running and entire cars were turning over to dump coal. In the background rose an airport, completely elevated—as if the stadium of Soldiers' Field were filled with earth to its top-most cornice and then sodded over.

"Light marched on, illuminating elevated highways leading to the next city. America, from the serpentine penstocks on the tawny mountain sides to the most delicate mechanisms in the low-head and the high-head hydro-electric stations, the America of farm and flat and mine and quarry and executive office, was electrically at work.

"This three-dimensional picture is ninety-five feet long and its scale is three-sixteenths of an inch to one foot in diminishing perspective. From its front edge the spectator looks upon a depth of twenty miles of mountain, valley, plain, and city to the horizon line. Its purpose is to show at a glance—and it does—the generation, transmission and utilization of electricity.



At the Christening of the Diorama

Left to right, front row, Charles G. Beersman, Miss Barbara Graf, R. J. Graf, Mrs. E. W. Lloyd. Back row, E. W. Lloyd, H. W. Fuller, W. H. Hodge, and L. F. Harza. This photograph was taken Saturday evening, May 6, at informal preview of the diorama shown above.

Miss Barbara Graf, daughter of Robert J. Graf, First Vice-President of the Byllesby Engineering & Management Corporation, and Vice-Chairman of the Electrical Central Station Industry Exhibit Committee, threw a switch which illuminated for the first time and placed into motion the diorama, after which Mrs. E. W. Lloyd, wife of the Vice-President of the Commonwealth Edison Company, and Chairman of the Electrical Central Station Industry Exhibit Committee, christened the diorama. More than seventy persons attended this preview.

APPOINTMENTS TO TECHNICAL COMMITTEES OF THE INSTITUTE

The personnel of the technical committees of the Institute is almost complete, with the exception of the Insurance Committee to which nominations have not yet been made. In some of the other committees there are still a few vacancies but these are expected to be filled before the first of June. The list of committee members, as approved by the Operating Committee at its last meeting, follows:

CODES AND STANDARDS COMMITTEE

(A Subcommittee of the Operating Committee)

A. H. KEHOE, *Chairman;* The New York Edison Co., New York, N. Y.
P. M. DOWNING, Pacific Gas & Electric Co., San Francisco, Calif.
H. P. LIVERSIDGE, Philadelphia Electric Co., Philadelphia, Pa.

ACCOUNTING COMMITTEE

J. H. LOBBAN, *Chairman;* The Detroit Edison Co., Detroit, Mich.
C. E. KOHLHEPP, Wisconsin Public Service Corp., Milwaukee, Wis.
H. D. ANDERSON, American Gas & Electric Co., New York, N. Y.
H. G. KESSLER, The Commonwealth & Southern Corp., New York, N. Y.
W. C. LANG, Electric Bond & Share Co., New York, N. Y.
F. J. BRETT, Niagara Hudson Power Corp., New York, N. Y.
L. R. NASH, Stone & Webster Service Corp., Boston, Mass.
WM. SCHMIDT, JR., Consolidated Gas, Electric Light & Power Co. of Baltimore, Baltimore, Md.
G. U. STEWART, Philadelphia Electric Co., Philadelphia, Pa.
DEAN H. MITCHELL, Northern Indiana Public Service Co., Hammond, Ind.
FRANKLYN HEYDECKE, Public Service Electric & Gas Co., Newark, N. J.
A. B. CARPENTER, San Joaquin Light & Power Corp., Fresno, Calif.

ELECTRICAL EQUIPMENT COMMITTEE

J. A. JOHNSON, *Chairman;* Buffalo, Niagara & Eastern Power Corp., Buffalo, N. Y.
R. E. ARGERSINGER, Stone & Webster Engineering Corp., Boston, Mass.
A. E. BETTIS, Kansas City Power & Light Co., Kansas City, Mo.
S. M. DEAN, The Detroit Edison Co., Detroit, Mich.
H. W. EALES, Byllesby Engineering & Management Corp., Chicago, Ill.
E. S. FIELDS, The Union Gas & Electric Co., Cincinnati, Ohio.
J. H. FOOTE, The Commonwealth & Southern Corp., Jackson, Mich.
S. J. LISBERGER, Pacific Gas & Electric Co., San Francisco, Calif.
A. E. SILVER, Electric Bond & Share Co., New York, N. Y.
W. F. SIMS, Commonwealth Edison Co., Chicago, Ill.
PHILIP SPORN, American Gas & Electric Co., New York, N. Y.
A. H. SWEETNAM, The Edison Electric Illuminating Co., Boston, Mass.
R. H. TAPSCOTT, The New York Edison Company, New York, N. Y.
R. W. WILBRAHAM, United Engineers & Constructors, Inc., Philadelphia, Pa.

(Two appointments to be made)

POWER GENERATION COMMITTEE

ALEX D. BAILEY, *Chairman;* Commonwealth Edison Co., Chicago, Ill.
PHILIP SPORN, American Gas & Electric Co., New York, N. Y.
J. T. BARRON, Public Service Electric & Gas Co., Newark, N. J.
F. S. CLARK, Stone & Webster Engineering Corp., Boston, Mass.
E. H. COLLINS, The Washington Water Power Co., Spokane, Wash.
GEORGE C. DANIELS, The Commonwealth & Southern Corp., Jackson, Mich.
C. W. DEFOREST, Columbia Engineering Corp., Cincinnati, Ohio.
JOHN DRABELLE, Iowa Electric Light & Power Co., Cedar Rapids, Iowa.
LOUIS ELLIOTT, Electric Bond & Share Co., New York, N. Y.
N. E. FUNK, Philadelphia Electric Co., Philadelphia, Pa.
NORMAN R. GIBSON, Buffalo, Niagara & Eastern Power Corp., Buffalo, N. Y.
ALFRED IDDLES, United Engineers & Constructors, Inc., Philadelphia, Pa.
EDWIN JOWETT, Kansas City Power & Light Co., Kansas City, Mo.
E. T. KECK, Texas Power & Light Co., Dallas, Texas.
W. C. DRUMMOND, Byllesby Engineering & Management Corp., Chicago, Ill.
A. H. MARKWART, Pacific Gas & Electric Co., San Francisco, Calif.
C. F. MERRIAM, Pennsylvania Water & Power Co., Baltimore, Md.
R. E. DILLON, The Edison Electric Illuminating Co., Boston, Mass.
PAUL W. THOMPSON, The Detroit Edison Co., Detroit, Mich.
A. L. PENNIMAN, JR., Consolidated Gas, Electric Light & Power Co., Baltimore, Md.
G. G. POST, The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.
E. B. RICKETTS, The New York Edison Co., New York, N. Y.
H. G. ROBY, Byllesby Engineering & Management Corp., Chicago, Ill.
T. H. SOREN, The Hartford Electric Light Co., Hartford, Conn.
E. H. TENNEY, Union Electric Light & Power Co., St. Louis., Mo.

(One appointment to be made)

PRIZE AWARDS COMMITTEE

FRANK W. SMITH, *Chairman;* The New York Edison Co., New York, N. Y.
GEORGE B. CORTELYOU, Consolidated Gas Co., New York, N. Y.

(A third member yet to be selected)

RATE RESEARCH COMMITTEE

F. A. NEWTON, *Chairman;* The Commonwealth & Southern Corp., New York, N. Y.
B. B. BECKETT, Pacific Gas & Electric Co., San Francisco, Calif.
J. E. GRAY, New England Engineering & Service Corp., Boston, Mass.
H. H. AGEE, Public Service Electric & Gas Co., Newark, N. J.
L. R. LEFFERSON, Electric Bond & Share Co., New York, N. Y.

J. T. KIMBALL, Niagara Hudson Power Corp., Buffalo, N. Y.

C. E. NEIL, The North American Co., New York, N. Y.

E. N. STRAIT, Byllesby Engineering & Management Co., Chicago, Ill.

(One other appointment to be made)

SALES COMMITTEE

GEO. E. WHITWELL, *Chairman;* Philadelphia Electric Co., Philadelphia, Pa.

P. S. ARKWRIGHT, Georgia Power Co., Atlanta, Ga.

JOSEPH F. BECKER, The New York Edison Co., New York, N. Y.

W. C. BELL, New England Power Assn., Boston, Mass.

J. W. BUSCH, Illinois Power & Light Co., Chicago, Ill.

R. D. CUTLER, The Hartford Electric Light Co., Hartford, Conn.

J. E. DAVIDSON, Nebraska Power Co., Omaha, Neb.

DAVIS M. DEBARD, Stone & Webster Service Corp., New York, N. Y.

L. L. EDGAR, The Edison Electric Illuminating Co., Boston, Mass.

R. E. FISHER, Pacific Gas & Electric Co., San Francisco, Calif.

B. H. GARDNER, Columbia Engineering Corporation, Columbus, Ohio.

W. H. HODGE, Byllesby Engineering & Management Corp., Chicago, Ill.

E. W. LLOYD, Commonwealth Edison Co., Chicago, Ill.

C. E. MICHEL, Union Electric Light & Power Co., St. Louis, Mo.

G. E. MILLER, The Cleveland Electric Illuminating Co., Cleveland, Ohio.

P. H. POWERS, West Penn Power Co., Pittsburgh, Pa.

H. F. SMIDDY, Electric Bond & Share Co., New York, N. Y.

F. J. RUTLEDGE, The United Gas Improvement Co., Philadelphia, Pa.

W. H. SAMMIS, The Commonwealth & Southern Corp., New York, N. Y.

H. M. SAWYER, American Gas & Electric Co., New York, N. Y.

M. E. SKINNER, Niagara Hudson Power Corp., Buffalo, N. Y.

H. P. J. STEINMETZ, Public Service Electric & Gas Co., Newark, N. J.

R. H. TILLMAN, Consolidated Gas, Electric Light & Power Co., Baltimore, Md.

H. E. YOUNG, Northern States Power Co., Minneapolis, Minn.

(Three appointments to be made)

STATISTICAL COMMITTEE

WM. J. HAGENAH, *Chairman;* Standard Gas & Electric Co., Chicago, Ill.

J. M. BURCHILL, American Gas & Electric Co., New York, N. Y.

E. J. FOWLER, Commonwealth Edison Co., Chicago, Ill.

LORIN IMLAY, Niagara Hudson Power Corp., Buffalo, N. Y.

LYLE MCDONALD, Public Service Electric & Gas Co., Newark, N. J.

R. G. SMITH, The North American Co., New York, N. Y.

HARRY A. SNOW, The Detroit Edison Co., Detroit, Mich.

W. G. VINCENT, Pacific Gas & Electric Co., San Francisco, Calif.

TRANSMISSION AND DISTRIBUTION COMMITTEE

MARK ELDREDGE, *Chairman;* Memphis Power & Light Co., Memphis, Tenn.

P. H. CHASE, Philadelphia Electric Co., Philadelphia, Pa.

A. E. BETTIS, Kansas City Power & Light Co., Kansas City, Mo.

MERRILL DEMERIT, West Penn Power Co., Pittsburgh, Pa.

S. M. DEAN, The Detroit Edison Co., Detroit, Mich.

B. L. HUFF, The Commonwealth & Southern Corp., New York, N. Y.

T. H. HAINES, The Edison Electric Illuminating Co., Boston, Mass.

G. G. POST, The Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

D. W. ROPER, Commonwealth Edison Co., Chicago, Ill.

L. G. SMITH, Consolidated Gas, Electric Light & Power Co., Baltimore, Md.

H. R. SEARING, The New York Edison Co., New York, N. Y.

PHILIP SPORN, American Gas & Electric Co., New York, N. Y.

H. P. SEDWICK, Public Service Co. of Northern Illinois, Chicago, Ill.

A. E. SILVER, Electric Bond & Share Co., New York, N. Y.

C. T. SINCLAIR, Byllesby Engineering & Management Corp., Pittsburgh, Pa.

J. S. WARE, Public Service Electric & Gas Co., Newark, N. J.

(Two appointments to be made)

ENGINEERING ACTIVITIES OF THE INSTITUTE

The selection of the personnel of the three engineering committees of the Institute has been practically completed, and active work of the committees will begin with their first meetings, which will be held during the June Convention at Chicago.

The organization of these committees has been carried out upon the plan formulated by the Operating Committee, which contemplated a complete coverage of the range of central station engineering with an appropriate concentration of work within this range upon objectives that are of direct importance under existing conditions and most likely to produce results of immediate practical usefulness. With this in view, the scopes of the Power Generation, Transmission and Distribution and Electrical Equipment Committees have been adjusted to cover the field from the prime sources of energy to the service of lamps, motors and other utilization equipment and to provide for supervision of the various aspects of engineering in this field, not only for design, construction and operation but also for the technical problems of management, economics and research.

Likewise the members of the three committees have been selected with a view to assembling men combining the point of view of management with a high degree of professional talent, whereby these committees shall not only be professionally authoritative in their fields but will insure by their managerial experience that the works undertaken by them are necessary and useful, and also that these works will be conducted in a business like and efficient manner.

The outstanding change in organization is that the former agencies for control and exercise of executive viewpoint, discarded for the sake of simplicity, have now been placed within the committees themselves, thereby effecting an arrangement which is expected to provide more direct and responsive contacts with the problems of management.

The lines of activity that have proved to be useful heretofore will in all probability be followed and carried to new usefulness. The means for doing this will have been changed and greatly simplified but the objectives, where they have justified themselves, will be the same.

The final meetings of the committees of the former engineering section were held early in April. The formation of the new committees has proceeded with sufficient speed to insure practically uninterrupted continuity in essential activities, especially in those cases where there is reasonable certainty that the work will be carried on by the new committees.

Provision will be made for the publication of a number of reports completed or turned in by the former committees at their final meetings. It is probable that those reports which constitute the latest contributions to definite series on the same subjects extending over several years, such as certain reports of the former Prime Movers Committee, will be published in a format suitable for binding with former issues on the same subject. Other reports, especially shorter ones, will probably be published in the EDISON ELECTRIC INSTITUTE BULLETIN.

Other work in progress, such as the uncompleted projects of the former committees, continuing duties like the routine collection and periodic publication of certain operating or other data, timely projects that had been discussed but not started by the former committees in view of their impending dissolution, will all be considered by the new committees and appraised for their current utility in view of the available means for executing the required work.

It has been pointed out before but it is perhaps worth repeating that under existing circumstances it will be necessary to establish a relative order of urgency and merit among these activities. In this connection, it will be useful to bear in mind that failure to achieve an early priority does not by any means denote indifference to the merits of a particular project but merely the very practical necessity of adjusting the available means to the most useful ends.

SALES COMMITTEE READY TO GO

Organization of commercial activities of the Edison Electric Institute for 1933-34 has been keeping pace with other organizational progress. As announced in another page of this issue of the *Bulletin* the General Sales Committee has been appointed and the prominence of the men in membership assures wide vision in forwarding committee work.

The Sales Committee is under the able and forceful leadership of George E. Whitwell, Vice-President of the Philadelphia Electric Company, which doubly assures effective organization and vigorous execution.

GEORGE E. WHITWELL
Chairman, Sales Committee

The announcement that the dissolution of N.E.L.A. would not bring to a close the major sustained national programs on electric refrigeration and electric cooking, and the acceptance of sponsorship of these programs by the Institute elicited wide commendation. The Electric Refrigeration Bureau is well along in its third year, and represents the first sales program of this duration in the history of the industry. Mr. J. E. Davidson has remained at the helm from the start and has not relinquished his interest and enthusiasm, and continues to contribute his time and effort for successful culmination of the program.

The National Electric Cookery Council was launched in the trough of business depression, but the range manufacturers in a spirit of optimism and determination agreed to go forward for a trial period. It is significant that the last meeting of the Executive Committee of the Council, meeting at New York on the day of the declaration of the National Bank Holiday, decided to continue the program along the lines originally laid out until the first year of effort was completed. Mr. Preston S. Arkwright, National Chairman of the Council, has been a vigorous sponsor for, and supporter of the electric range. Fortunately Mr. Arkwright continues in his capacity as Chairman.

Readers of the *Bulletin* have been kept informed of the field work of both the Bureau and the Council. The potential value of these two commercial units of the Institute in promoting national and coordinated sales effort and better trade relationship is evident in these reports.

In addition to these two national programs the work of the Sales Committee will be carried on under six sub-committees as follows: *Air Conditioning,* including commercial and domestic; *Lighting Sales,* including the lighting of all indoor and outdoor areas in all fields of operation; *Industrial Power and Heating Sales,* including competitive power in commercial fields; *Residential Sales,* with special emphasis on group sales—The Electric Kitchen, Home Laundry and complete home electrification; *Wiring,* covering adequacy and exploring new methods; *Rural Sales,* including all the problems of farm electrification.

Chairman Whitwell will shortly announce the names of the chairmen of these committees and the personnel will be completed at an early date.

The program of the Convention of the Institute on Wednesday, June 7, will be devoted to commercial subjects. An informative and entertaining program has been completed. This happens to be Electrical Day at the Century of Progress Exposition and it is fitting that commercial development be highlighted.

Chairman Whitwell is calling a meeting of the Sales Committee on Monday, June 5, at three o'clock at the Palmer House, and on the day previous he will hold a meeting of sub-committee chairmen at which the committee personnel will be selected and scope of activities determined.

The commercial work of the Institute will be ready to GO as the curtain falls on its first Convention.—C.E.G.

PROGRESS IN BARE NEUTRAL AND NON-METALLIC WIRING METHODS

By J. D. NOYES
Detroit Edison Company

Actions taken at the March meeting of the Electrical Committee of the National Fire Protection Association were in many respects encouraging to the advocates of bare neutral systems for interior wiring and the use of non-metallic wiring methods. Many extensive and detailed changes were made in the text of the National Electrical Code, and a good proportion of these recognize changes in practice that have been urged by central stations and which will greatly assist in the employment of modern methods for service entry and the supply of major appliances. A complete catalogue of these changes would be impossible in this brief article; it is my particular purpose to record the actions of the committee on the progress of bare neutral and non-metallic wiring even where some of these actions did not result in actual changes of the Code text.

The question of bare neutral wiring was dealt with in a report rendered by a special committee which had been previously appointed by the Electrical Committee to study this question. The conclusions presented in the report of this Special Committee are as follows:

1. Possible economies and advantages may accrue from the use of bare neutral wiring.
2. Any hazards involved in the use of a bare neutral conductor up to outlet points under the conditions specified in this report, do not appear to be greater than those existing with types of wiring now recognized in the National Electrical Code under conditions found in actual installations.

The Electrical Committee received this report and also adopted two resolutions providing for further study. The first of these instructed that the Special Committee be continued and instructed to proceed to the formulation of Code rules in cooperation with the appropriate standing subcommittee. The text of this resolution was as follows:

> That the committee be continued and instructed to prepare a digest of installation rules and practices as exhibited by trial installations of bare neutral now existing and sent to Article 5 Committee as a basis for permissive rules to be presented to the next meeting of this committee.

The second resolution recommended to inspection authorities that they consent to reasonably limited numbers of bare neutral installations for the sake of the experience to be gained, in the following terms:

> It is the sense of the meeting in view of the findings of the Special Committee on Bare Neutrals in Wiring Systems, that regulatory bodies, in order that further field experience can be gained and so that the Committee on Article 5 may have practical guidance, may reasonably consent to further development in the field of a reasonably limited number of installations when made under controlled conditions.

In addition to these actions, the new text of the Code, at Section 404-e, will definitely recognize the use of bare neutrals in service entrances where rigid conduit, electrical metallic tubing or approved types of service entrance cables are used.

In a similar manner some Code changes were made, and an important resolution was taken which expressed the sense of the meeting and reflected an appreciation of the merits of non-metallic systems of wiring, especially for application to rural installations, and where water pipe grounding is not available. These actions evidently take into account the experiences and the growing preference for non-metallic systems for rural installations as found in New York, Michigan, Wisconsin, the Province of Ontario in Canada and elsewhere.

In the Code, Section 507-b, the first sentence concerning the installation of non-metallic sheathed cable, which formerly required "continuously dry locations" has been amended to require definitely that this material "shall not be installed in masonry, concrete or fill nor be buried in plaster."

A resolution by the electrical inspectors was offered to the meeting, recording the sense of the meeting that non-metallic wiring systems were preferable in rural installations where artificial grounds were employed. After debate, however, this question was referred in the following form to the subcommittee on grounding, for report at the next meeting:

"In rural districts where low-resistance grounds cannot be obtained, it be recommended that non-metallic wiring systems be used."

MORE LIGHT ON THE ELECTRIC SERVICE BILL

Mr. Owen D. Young, Chairman of the Board of the General Electric Company, speaking one time before a utility group stated: "It isn't good enough to give good service. Until the customer understands the goodness of that service the job is not done."

One of the outstanding and the most difficult of jobs is to make the public know and to understand. It is a continuing problem with the utility.

How many consumers today refer to the monthly bill for electric service as the "Light" bill. This is a relic of many years' standing but the utility has been unable to change the thinking of all the consumers.

If we could analyze each customer's bill, and segregate each service rendered and allocate the cost in an itemized bill, the company would have a convincing argument for the comparative low cost of electric labor in the home.

Looking back to the boom year of 1929, we learn from an analysis by Mr. W. M. Carpenter, our Economist, that the takings of electricity by householders varied widely in amounts. At that time less than one million domestic consumers used over 100 kilowatt-hours per month. These customers used approximately 27 per cent of the total energy output for this class of service.

Another fifteen million, or approximately 75 per cent, used a maximum of 50 kilowatt-hours monthly. That is, in the homes of 75 per cent of the utilities' customers, the installation of an electric refrigerator would practically double consumption. The rapid growth in sales of electric refrigerators over the past three years without question has changed the figures in the upper bracket groups, but even at the present time, one-half of all American homes use less than 30 kilowatt-hours a month. A fair estimate of the average energy use in homes without refrigerators would be 360 kilowatt-hours.

Taking a hypothetical case, let us assume normal use of a list of appliance services billed at a rate of 7c. per kilo-

watt-hour. The bill might appear something like this:

MONTHLY STATEMENT (Customer A)

Service	*Kilowatt-hours*	*Estimated Cost*
Lighting	15	$1.05
Washing	1	.07
Ironing	4	.28
Cleaning	1	.07
Toasting	1.5	.11
Mixing & Extracting	1	.07
Sewing	0.5	.035
Hair-curling	0.5	.035
Radio Entertainment	4	.28
Ringing Bells & Telling Time	1.5	.10
	30	$2.10

Or let us assume the consumer has a full-use service and has added refrigeration, cooking, water heating and electric oil furnace. The consumer would be a better user of light and smaller appliances. The bill for electricity might assume the following form:

MONTHLY STATEMENT (Customer B)

Full-use Service

Service	*Kilowatt-hours*	*Estimated Cost*
Lighting	30	$2.10
Washing	2	.10
Ironing	6	.30
Cleaning	2	.10
Refrigeration	50	2.00
Cooking	145	4.35
Water Heating	250	3.75
Toasting	3	.15
Mixing & Extracting	2	.10
Coffee-making	3	.15
Hair-curling	1	.05
Radio Entertainment	6	.30
Heating (Oil Furnace)	25	1.00
	525	$14.45

Although this is a theoretical analysis, the idea has practical application in its explanation to the individual consumer, particularly the consumer who is aggrieved at the amount of his bill for "Light." It can be readily shown how low average rates can be earned, as Customer "B" here illustrated uses more than seventeen times the current of Customer "A" for less than seven times the amount of the bill of the low-use consumer. The specific services rendered through the appliances in a consumer's home can be analyzed to the mutual advantage of the company and customer.

We can "tell the world" about rates through booklets or through the newspapers. The newspaper is powerfully effective. But there is no such effective method as contact with the individual or smaller groups. The Home Service Director, for example, may find this method adaptable in some of her presentations to smaller groups of women.

The public appreciates the service of the utility only as they understand the service and what it means to them. Under the "New Deal" it is important that this understanding be expressed as nearly as possible in dollars and cents. One of the most effective presentations that has come to the writer's attention in recent years was that series of newspaper advertisements by the Northern States Power Company on "The Power of the Penny." It was most deserving of the award which it won from Harvard University. The concept in this series has even greater potential power in these times of economic stress. The story has been told of the "goodness" of the service. The value of that service for the price paid has yet to be effectively told throughout the entire utility field.—C.E.G.

NATIONAL ELECTRIC COOKERY COUNCIL

News from the Field

The New Victory Contest launched by the National Electric Cookery Council April 1st is attracting widespread interest among all classes of eligible contestants throughout the country. From the great metropolitan centers to the smallest of hamlets come enrollments in the Dealers' and Salesmen's contests. The ease of participation, the liberality of the prize awards, the uniformly even chances for winning, and a general tendency of utilities and dealers to energetically go after the highly profitable electric range business account largely for the substantial entry list to date.

Formal announcement of enrollment up to May 1st includes 34 Local Cookery Councils or equivalent organizations, 37 Utility Commercial Managers, with conservative estimates of 285 Retail Dealers and 800 Retail Salesmen and more coming in daily.

Advance notification of participation was not stipulated as compulsory in the terms of the contest and complete entry records are not available but from information received indirectly through field reports it is estimated that approximately 16 Local Cookery Councils, 33 Commercial Managers, 130 Dealers and 250 Salesmen are competing in addition to the enrollment by letter.

This National Contest is greatly stimulating efforts toward electric range sales, particularly in those territories where definite range campaigns are in progress.

The North Central section of the country is evincing active interest in the National Electric Cookery Council program as it is applied to local situations and also in the New Victory Contest.

Mr. A. H. Jaeger, field representative, during the past month has addressed meetings and conferences at Bismarck, Jamestown, Minot, Devils Lake and Fargo, N. D.; Mitchell, Aberdeen, Huron, Deadwood, Hot Springs and Sioux Falls, S. D.; Scottsbluff and Columbus, Neb.; Fergus Falls, St. Cloud, Mankato, Winona and Minneapolis, Minn. As a result, Local Cookery Councils have been organized at Jamestown, Devils Lake, Huron, St. Cloud, Winona and Fergus Falls. Other situations in this section are striving for more active dealer participation in the promotion of electric cookery.

Mr. Jaeger is at present traveling through the Great Lakes Division, addressing Cookery Council organizations previously formed, and assisting in others that plan to organize in the immediate future.

With the assistance of Mr. E. L. Hinchliff, field representative, a Cookery Council was formed in April and is now actively under way at Cedar Rapids, Iowa.

A message from Louisville, Ky., states that seven Local Cookery Councils have just been organized in the territory served by the Kentucky Utilities Company. Mr. L. W. McLellan, Operating Sponsor, has expressed appreciation of the assistance of Mr. Hinchliff. This group of Councils will be worthy of watching if the plans and activities proposed are carried out.

Every Tuesday, in the private dining room of the Toledo, Ohio, Chamber of Commerce, the members of the Toledo Electric Cookery Council meet to discuss their plans and problems in a fraternal spirit. At the luncheon meeting of April 25, Field Representative Collins, of the National Electric Cookery Council, was the guest and extended discussions took place revolving around "brass tack" plans for electric cookery promotion in Toledo. Chairman Ed. F.

Schmidt and Executive Secretary R. H. Winters, Jr., and their associates are keeping the cookery ball rolling.

The Electric League of Reading, Pa.; is conspicuous among Leagues by reason of its exhibit room and show window on the street level in the business section of the city. Recently, the Electric Cookery Council of the League decided to promote the Kitchen Modernization movement and collaborated with the Building Trades Exhibit in Reading and exhibited the All-Electric Kitchen idea. Later this exhibit was removed and reinstalled in the League's Show Window, thus attracting additional attention of the passing public. The Reading Electric Cookery Council has entered the New Victory Contest.

At a meeting of the Findlay, Ohio, Electrical Dealers Association on April 27th, the Findlay Electric Cookery Council was organized within the Association. This Association embraces the leading dealers of Findlay and has the cooperative support of the Central Ohio Light & Power Company.

The program of the Annual Sales Conference of the Tri-State Electrical Association, held at the Netherland Plaza Hotel, Cincinnati, Ohio, April 20 and 21, read "No Speeches—Open Discussion—Exchange of Ideas." This new conference idea for a convention, under the General Chairmanship of F. S. Dewey, The Union Gas & Electric Co., Cincinnati, was eminently successful. Outstanding among the discussions was that on Electric Cookery at the afternoon session, April 20th, presided over by H. N. Wood, Ohio Edison Co., Youngstown, Ohio. Field Representative Collins outlined the plans of the National Council and suggested means for local application. He emphasized that only through local cooperative organization could full impetus be given electric range promotion in any community and stressed the need of having the best merchants of each community enlisted in the local councils. Leading the various phases of the discussion were Mr. Wilhelmy (Union Gas & Electric), Mr. McLellan (Kentucky Utilities Co.), Mr. Kirkpatrick (Ohio Power Co.), Mr. Schmidt (Toledo Edison Co.), and Mr. Albert Kahn, Secretary of the Estate Stove Company, Hamilton, Ohio.

At the General Luncheon Meeting of the Association, April 21, Mr. C. L. Dunn, Ohio Public Service Co., Cleveland, Ohio, speaking in behalf of Mr. T. O. Kennedy, Divisional Director of the National Electric Cookery Council, called attention to the New Victory Contest to run nationally through April, May and June and urged participation by councils and retail salesmen so that some of the prizes might come to Ohio, Kentucky or West Virginia.

The first complete meeting of the Lebanon, Pa., Electric Cookery Council took place the evening of April 18th, with a full attendance.

President Frank G. Heisey introduced Field Representative Collins of the Council, and asked him to outline the plans of the National Council. A definite program of local activities is now being undertaken by this group.

On April 13th President C. S. Banghart, of the Metropolitan-Edison Company, Reading, Pa., presided at a Luncheon Meeting of the Five Electric Cookery Councils throughout his territory, the meeting being held at the Wyomissing Club, Reading. With Mr. Banghart were Messrs. A. E. Ward, Associated Gas & Electric Co., N. Y., Leslie Weiss, Sales Manager, Metropolitan-Edison Co., and his assistant, A. B. Pursell. The heads of the five electric cookery councils were present from Reading, Hanover, Easton, Lebanon, Pa., and Dover, N. J., as well as Field Representative Collins of the Council.

President Banghart launched the interesting program, the feature of which was the presentation by Mr. Leslie Weiss of the ambitious activity revolving around the Kitchen Modernization movement with the electric range as the cornerstone.

Since the inauguration of these five councils in November, 1932, a continuous electric cookery program has followed, month by month, without let-up, and the resulting sale of electric ranges throughout the territory embraced has been very gratifying to all concerned.

Under the Chairmanship of Vice-President R. D. Cutler, of the Hartford Electric Light Company, the first meeting of merchants and dealers was held in the Company's auditorium March 24th, at which the National program was outlined by its Field Representative A. B. Collins. The second, and organizational meeting, was held April 10th, and at this meeting Chairman Cutler presented definite plans devised with the assistance of several of the leading merchants of Hartford. After a most complete discussion, the Hartford Electric Cookery Council definitely was formed and a committee of five (including four merchants) was appointed to work out the organization details and program. The meeting also endorsed a vigorous sales campaign to run from April 19th to June 1st.

SUBSCRIPTIONS TO EDISON ELECTRIC INSTITUTE BULLETIN

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IMPEDANCE CHARACTERISTICS OF COPPER-COVERED-STEEL CONDUCTORS

In the course of its study of means for coordinating supply and communication systems, the Joint Subcommittee on Development and Research is frequently required to extend its investigations into fields which on the surface may appear to have little connection with the main purpose of this activity. A recent illustration of such an investigation is an experimental investigation of the impedance characteristics of copper-covered-steel conductors.

Transmission lines are frequently equipped with copper-covered-steel overhead ground wires. In cases of single phase to ground faults these ground wires carry an appreciable amount of the fault current and set up magnetic fields opposing those produced by the fault current in the phase conductors. They are, therefore, effective in reducing voltages which might otherwise appear on other nearby circuits as a result of power system fault to ground. On the other hand the location of the ground wires in a position which is not symmetrical with respect to the phase conductors may result in induced currents in the ground wires due to the balanced phase wire current, and thus cause induction in ground return circuits. The amount of the modification in the magnetic field surrounding a power circuit equipped with ground wires is dependent upon their impedance and more particularly upon their resistance. Since such conductors contain iron their resistance and reactance are both dependent upon current density in the conductor. If the effect of ground wires on an existing line is to be calculated, or the increase in effect which would be secured by a change in the size or type of ground wires is to be computed it is necessary to know with a fair degree of accuracy the impedance characteristics of the conductor, including its change with current density.

Available data on conductors of this type were very limited and were based upon tests made a number of years ago and, therefore, not necessarily applicable to conductors made under present manufacturing conditions. With the cooperation of one of the manufacturing companies who supplied a number of samples of stranded copper-covered-steel conductors the Joint Subcommittee on Development and Research carried out a number of tests in the laboratory to determine the characteristics of these conductors. The sample under test was arranged in the form of a circle about 6 ft. in diameter and energized with currents of either 60 or 25 cycles. The magnitude of the voltage drop, and its phase relationship with respect to the current in the conductor, were measured with an a-c potentiometer*. The quantities desired from these measurements were the internal resistance and reactance of the conductor itself. These could be secured by subtracting from the voltage impressed across the sample the calculated voltage of self induction due to the configuration of the sample, and dividing this quantity by the current in the sample (this calculated value could be checked experimentally by replacing the copper-covered-steel sample by a conductor of similar size and shape, which did not contain magnetic material). It was found, however, that the internal impedance of the test specimen

(Continued on page 47)

* This potentiometer was described in an article appearing in the *N.E.L.A. Bulletin* for April, 1930.

Cable Structure					Freq.	.25						∞					
	Stranding						Resistance			Eff. Permeability				Resistance			Eff. Permeability		
Dia.	Number of Wires	Copper	Copper Covered-Steel *	Cable Cross-Section	D-C Res. at 70°F. Entire Cable	Current Range in Amps	Ave.	Max.	Min.	Ave.	Max.	Min.	Current Range in Amps	Ave.	Max.	Min.	Ave.	Max.	Min.
21/32"	19		19-#8-40%										5-150	0.0995	0.101	0.0975	5.8	6.1	5.5
	19		19-#8-30%		.108								5-215	.118	.124	.111	6.4	6.7	5.5
1/2"	7		7-#6-40%		.137	5-230	0.143	0.161	0.138	6.1	6.7	5.8	5-230	.150	.156	.145	5.2	5.5	5.2
	7		7-#6-30%		.182	5-200	.188	.199	.185	7.3	7.5	6.4	5-200	.195	.207	.192	5.9	6.3	5.6
3/8"	7		7-#8-40%		.220	5-220	.226	.244	.219	7.2	8.5	6.5	5-200	.235	.253	.223	6.1	6.9	6.0
	7		7-#8-30%		.281	5-160	.284	.290	.278	7.2	8.4	6.5	0.15-160	.290	.297	.284	6.3	6.8	6.0
5/16"	7		7-#10-40%		.350								5-145	.368	.373	.362	5.7	6.3	5.2
	7		7-#10-30%		.440								5-140	.465	.484	.452	6.7	7.5	6.0
	3		3-#7-40%		.395								5-120	.397	.403	.395	5.6	6.2	5.2
	3		3-#7-30%		.521								5-120	.553	.560	.542	6.2	6.7	5.3
Composite Cables																			
0.540"	19	12-#8	7-#8S-30%										5-150	0.0505	0.0516	0.0497	2.3	2.4	2.2
3/8"	7	3-#8	4-#8S-30%		.152								5-150	.162	.168	.156	4.9	5.0	4.5
	7	4-#8	3-#8S-30%		.130								5-150	.136	.139	.134	4.6	5.0	4.3
	7	6-#8	1-#8S-30%		.101								5-150	.106	.107	.104	3.1	3.3	3.0
	1	1-#7	2-#7 -30%		.309								5-120	.316	.322	.315	5.3	5.5	4.9
	3	2-#7	1-#7 -30%		.219								5-120	.225	.227	.222	4.4	4.5	4.2

* Wire size = B & S gage S = Extra High Strength copper-covered-steel wires; all other values for High Strength copper-covered steel wires

● Copper Conductor ○ Copper-covered-steel conductor

Internal Reactance (ohms per kilofoot) / .00575 = Effective Permeability or Internal Inductance ratio at 60 cycles

Internal Reactance (ohms per kilofoot) / .00239 = " " " " " " " 25 cycles

All test specimens furnished by Copperweld Steel Company.

INTERNAL IMPEDANCES OF COPPER-COVERED-STEEL CONDUCTORS AT 70° F. OHMS PER KILOFOOT

ELECTRIC REFRIGERATION BUREAU REPORTS SALES FOR FIRST QUARTER OF 1933

Total Estimated at 112,643 Units—Spring Refrigeration Shows Break Attendance and Sales Records

Electric refrigerator sales in the United States during the first three months of 1933, while under those of a year ago, showed an encouraging increase toward the end of the period. According to the Bureau's tabulation the total for March was just about equal to that of January and February combined. Scattered information from various sources, such as the reports of scores of successful refrigeration shows held throughout the country and preliminary statements from a number of the leading manufacturers, indicate that April will show a still further increase and may approach, if not exceed, the business of April, 1932.

Based upon the reports of the various members of the NEMA group of manufacturers, the Bureau estimates the total sales of household units for the quarter at 112,643, of which 58,494 were sold in March. The three months' total represents 70.2 per cent of the Bureau's quota of 160,434. The states of Missouri, Maryland (including the District of Columbia), Alabama, Texas, South Carolina and Virginia exceeded their quotas, Missouri leading with 125.2 per cent. Georgia, Arizona, New Mexico and Colorado exceeded 90 per cent, while New York, with the largest sales total, 21,677, realized 87.4 per cent of its quota. The complete tabulation by states may be found in another column.

LEGION OF HONOR CONTEST

As this issue of the BULLETIN goes to press, the entries for the Bureau's Legion of Honor Contest, to determine and reward the most outstanding individual accomplishments in co-operative sales effort and Bureau organization work in each of the eleven regional divisions of the Bureau, are in the hands of the judges. Contestants entered from twenty-four states, every one of the eleven divisions being represented.

The judges of the contest are Mr. A. W. Berresford, Managing Director of the National Electrical Manufacturers Association; Mr. J. C. Sterling, Advertising Director of *McCalls* Magazine, and Mr. E. Kobak, Vice-President of McGraw-Hill Publishing Co., Inc. The winners will be announced in the next issue of the BULLETIN.

ELECTRIC REFRIGERATION BUREAU
SALES—HOUSEHOLD MODELS ONLY—FIRST THREE MONTHS 1933

	THREE MONTHS QUOTA—20%	ESTIMATED TOTAL SALES	% QUOTA REALIZATION
New England Division			
Connecticut	3,063	1,690	55.1
Maine	1,247	725	58.1
Massachusetts	7,806	5,403	69.2
New Hampshire	802	429	53.4
Rhode Island	1,287	928	72.1
Vermont	525	332	63.2
Eastern Division			
Delaware	321	227	70.7
Maryland & D. C.	3,189	3,883	121.7
New Jersey	7,804	4,895	62.7
New York	24,790	21,677	87.4
Pennsylvania	13,750	9,678	70.3
East Central Division			
Kentucky	1,787	1,429	79.9
Ohio	10,246	5,536	54.0
West Virginia	1,230	1,053	86.3
Middle West Division			
Iowa	3,046	1,661	54.5
Kansas	2,269	1,621	71.4
Missouri	4,416	5,529	125.2
Nebraska	1,567	869	55.4
Pacific Coast Division			
Arizona	459	425	92.5
California	12,547	7,826	62.3
Nevada	114	52	45.6
Northwest Division			
Idaho	516	167	32.3
Montana	557	378	67.8
Oregon	1,579	737	46.6
Utah	770	156	20.2
Washington	2,854	1,077	37.7
Southeastern Division			
Alabama	1,094	1,223	111.7
Florida	1,537	822	53.4
Georgia	1,307	1,261	96.4
North Carolina	1,720	1,239	72.0
South Carolina	686	730	106.4
Tennessee	1,566	1,037	66.2
Virginia	1,747	1,755	100.4
Great Lakes Division			
Illinois	12,291	8,502	69.1
Indiana	4,477	2,135	47.6
Michigan	7,038	2,095	29.7
Wisconsin	4,138	1,517	36.6
North Central Division			
Minnesota	3,162	2,064	65.2
North Dakota	399	189	47.3
South Dakota	512	277	54.1
Rocky Mountain Division			
Colorado	1,349	1,222	90.5
New Mexico	218	198	90.8
Wyoming	209	73	34.9
Southwestern Division			
Arkansas	733	483	65.8
Louisiana	1,305	1,048	80.3
Mississippi	548	307	56.0
Oklahoma	1,669	1,486	89.0
Texas	4,188	4,597	109.7
Totals	160,434	112,643	70.2

SPRING SHOWS DREW RECORD CROWDS

Reports received on the electric refrigeration shows held throughout the country during April indicate a tremendous increase in public interest in refrigeration, the figures from the great majority of the cities showing attendance, sales and prospect lists topping those of any previous exhibits.

Among the high spots may be noted the fifth annual electric refrigeration show of the Electrical Association of Philadelphia, which occupied two floors of the Edison Building and displayed twelve standard lines of refrigerators. The exhibit was host to more than 30,000 visitors during the week and sales from the floor totaled 231 units, an increase over last year notwithstanding the business conditions. More than 10,000 entries were received in two Limerick contests, the prize for each being a $250 refrigerator, and hundreds of active prospects were obtained during the course of the show, a large percentage of which should be closed in forthcoming weeks.

Concurrently with the Philadelphia show the Electrical Association of Philadelphia, in conjunction with local dealers, sponsored an exhibit in Chester, Pa., which attracted more than 12,000 people. The Limerick contest idea was also employed there and 81 sales, also more than last year's record, were made from the floor. Eleven distributors took part.

All local records were broken at the third annual Spring show conducted by the Electrical League of the Niagara Frontier at Buffalo, with the co-operation of the Buffalo Electric Refrigeration Bureau. The attendance exceeded 35,000, the sale of 291 refrigerators netted more than $50,000, and a list of 2,451 live prospects was secured, not to mention a preference list of more than 12,000 names. Fifteen of the better known makes were on exhibition.

Out in Kansas City the annual Spring exposition of the Electric Refrigeration Bureau of the Electric & Radio Association also outdrew last year's exhibit. The attendance was 7,751, and a remarkably high percentage of the patrons were converted into immediate customers. A total of 153 refrigerators was sold during the exhibit and within four days following its close, as against 125 sold in the corresponding period a year ago. Seventy-six models were shown by fourteen distributors.

An even higher ratio of sales to attendance than at Kansas City was recorded at the third annual Spring show of the Electrical League of South Jersey at Camden, where 128 units were sold on the floor, among 6,500 visitors. Each of the nine exhibitors received a prospect list of nearly 1,500 names, including 800 regarded as excellent leads.

Any list of outstanding Spring exhibits should not fail to include the one at Louisville, Ky., held by the local Bureau with the co-operation of the Louisville *Courier-Journal* and the Louisville *Times*. There was a record-breaking attendance of more than 25,000, and each of the nineteen exhibitors, without exception, reported more sales than at any previous show.

APRIL AND MAY MEETINGS

During the month of April, Field Manager Allison covered 5,700 miles in his travels, in the course of which he attended twenty meetings and addressed approximately 3,650 electric refrigeration men. Eight hundred attended the dinner meeting of the Metropolitan Electrical League of Boston held early in the month—probably an all-time record for co-operative refrigeration gatherings. At Elmira, N. Y., on the 26th, there was an audience of 700 dealers, salesmen and employees of the Southern New York Group of the Associated Gas & Electric System. The next evening 350 attended a similar meeting at Binghamton. F. H. Hill, President and General Manager of the New York State Electric & Gas Corporation, presided at both the Elmira and Binghamton meetings.

On April 24th, 300 dealers and salesmen attended the first of the weekly sessions of the salesmanship course sponsored by the Niagara Hudson Power Corporation and the Electrical League of the Niagara Frontier at Buffalo, where Dr. Allison spoke at length on refrigeration sales methods. The second lecture of the series was given on May 1st and was heard by a still larger audience. The final talk of the series was held on May 8th at which there was an attendance of 314.

On April 25th, 175 attended a meeting at Olean, N. Y., and on the 25th a meeting at Batavia attracted 135 dealers and salesmen. Both these meetings were held under the auspices of the Niagara Hudson Power Corporation.

Meetings were scheduled for the first part of May at Easton, Pa., on the 2nd; at Reading the 3rd; Lebanon, the 4th; Hanover, the 5th; Ithaca, N. Y., the 10th; Norwich, the 10th; Oneonta, the 11th; Walton, the 11th, and Liberty, the 12th. Following that, meetings were held in St. Louis on the 15th; Kansas City, the 16th; Oklahoma City, the 17th; Shawnee, the 18th; Muskogee, the 19th, St. Louis again the 22nd, and Pittsburgh the 23rd. Then came three more meetings in the Niagara Hudson Power Company territory at Jamestown, the 24th; Watertown, the 25th; and Potsdam, the 26th.

Immediately following Decoration Day, meetings have been arranged for Newport News on the 31st, Richmond, June 1st and Norfolk, the 2nd.

EIGHT NEW BUREAUS IN NEW YORK

Through the aggressive efforts of J. H. Van Aernam, Sales Promotion Manager, and other officials of the New York Power & Light Co., together with those of various distributors in the Albany, N. Y. district, eight new local Bureaus have been established in the following cities and towns in the utility's territory: Troy, Schenectady, Cohoes, Glens Falls, Saratoga, Ballston, Hudson, Gloversville and Canajoharie.

An Advisory Council was set up within the Albany Bureau. The New York Power & Light Co. offered the free use of its sales rooms as permanent meeting places, and each of the distributors appointed a representative to act as an organizer in one of the towns. A complete organization was formed in each community and all immediately made plans for the holding of Spring shows, most of which have already taken place.

CONGRATULATORY NOTE

"Cold Facts," the house organ of the Kelvinator Sales Corporation, contains in its May issue a lengthy editorial review of the article on the Bureau's achievements which appeared in the December issue of the *N. E. L. A. Bulletin*. The editorial concludes as follows:

"The electric refrigeration industry is indebted beyond estimate to the two years' work of the Electric Refrigeration Bureau. And the fact that the Bureau will continue its activities for a third year should be a matter of congratulation among manufacturers and sellers of this product."

The Bureau is indeed grateful for these kind words.

OUTDOOR METER INSTALLATIONS AND SUGGESTED FORM OF HOUSING FOR OUTDOOR METERS*

The practice of placing meters out-of-doors in metal cabinets or specially constructed cases, though not entirely a new idea, is now creating general interest. Outdoor metering of residential, small commercial and farm installations has advantages and disadvantages although local and climatic conditions do not warrant its universal use. It should be considered as some of the advantages may offer a solution to particular problems that would otherwise be difficult to solve.

The decision to adopt this type of metering should be based on the advantages to be derived.

The field in which outdoor metering will prove most useful will be the rural residential, farm and small commercial services. Each of these types of service offers a different problem in metering, and it is advisable that each be considered separately. Outdoor metering should also be advantageous in places of seasonable occupancy or other places that are necessarily kept locked such as, summer cottages, roadside stands, billboards, metered traffic signals and private garages.

The residential services out-number the other types and should therefore be considered first, for it is from this group that the greatest benefit might be derived. The points in favor of or against the placing of meters on exterior of buildings are set forth as an aid toward determining whether the practice is desirable.

Advantages

The proper installation of a meter out-of-doors will tend to prevent the diversion of current and if at a convenient location will minimize the time and labor required for changing, reading, inspecting and, in some cases, testing. It will also provide for uniform billing periods.

The cost of an outdoor metering installation will in most cases be comparable with an indoor metering installation.

Disadvantages

Weather conditions frequently encountered prevent rapid, accurate, regular and efficient testing of meters.

The presence of flowering plants, shrubbery and trees will in many cases prevent ease of access to the meter. Damage to such property may result in customer complaints or claims.

Developments in the design and construction of meters for outdoor use and their enclosing cases have not developed to a point where reliable performance and economical maintenance are assured.

The installation of meters out-of-doors will decrease employee contact with the customer, which some utilities consider desirable.

The reading of meters and billing of customers by a utility which also furnishes gas service will be rendered more difficult and expensive where electric meters are installed out-of-doors.

Many difficulties will arise in the selection of a location on the customer's building which will be satisfactory to him yet will not increase the cost to the utility. Such locations should be determined with due consideration for appearance of installation, the length of the service connection and type of building.

General

The arguments both for and against outdoor metering that apply to urban residential customers will, in a large measure, apply to those rural or farm services that are becoming more numerous each year. Diversion of current can be greatly decreased, the meter reader or tester, in most cases, can complete his work without a second trip, and the many scattered private line extensions usually found on a rural service can be more readily constructed by the customer when the meter is located at some central point out-of-doors. Possibly the only serious disadvantage to be encountered in rural out-of-door metering is the inability to test and maintain the meter during severe climatic conditions.

The small commercial services in congested districts cannot be readily adapted to the use of outdoor metering. All the advantages as stated for the residential service will apply while the disadvantages are magnified. The space available on the outside of most commercial buildings, particularly in metropolitan areas, is usually insufficient and undesirable for a meter location. In many instances the commercial buildings are served from underground systems. In such places the installation of meters outdoors is impracticable.

In general, out-of-door metering should be treated as a modern method that has merit and its application should be in accord with the normal progress of the times. It is possible that under certain conditions in some localities, the advantages will outweigh the disadvantages.

Modern types of outdoor metering at present are divided into three general classes:

1. Detachable type outdoor meter. See Figure No. 1.
2. The installation of a meter in a weather-proof cabinet that may contain test links or switches and fuses, or both. See Figures Nos. 3 to 7.
3. Indoor type meter installed on a porch. See Figure No. 6.

Certain undesirable outdoor metering locations are shown. See Figures Nos. 1 and 2.

Glass-covered meters used out-of-doors must be protected against breakage in certain localities. Figure No. 4 shows a protective housing applied to an outdoor meter.

Figure No. 5 shows a typical outdoor installation of a small group of detachable type meters located on an apartment house.

No attempt is made here to recommend any particular style or class of equipment for any locality. The selection of the equipment should be made after a careful study of conditions.

The N.E.L.A. Meter Committee suggests that the following features be incorporated in outdoor housings for standard watthour meters:

Suggested Form of Outdoor Housing for Bottom-Connected, Low-Capacity, Single-Phase Watthour Meters

1. The enclosure shall be small and compact. It shall provide sufficient space to accommodate any type of bottom-connected, single-phase meter now in general use, a disconnect and/or test device and wiring space adequate for a maximum wire size of No. 2 A.W.G. copper with National Electrical Code insulation.
2. The entire enclosure when installed fully equipped shall present a much more pleasing appearance than the folded type of en-

*A report prepared by the former National Meter Committee, N.E.L.A., E. A. LeFever, Chairman.

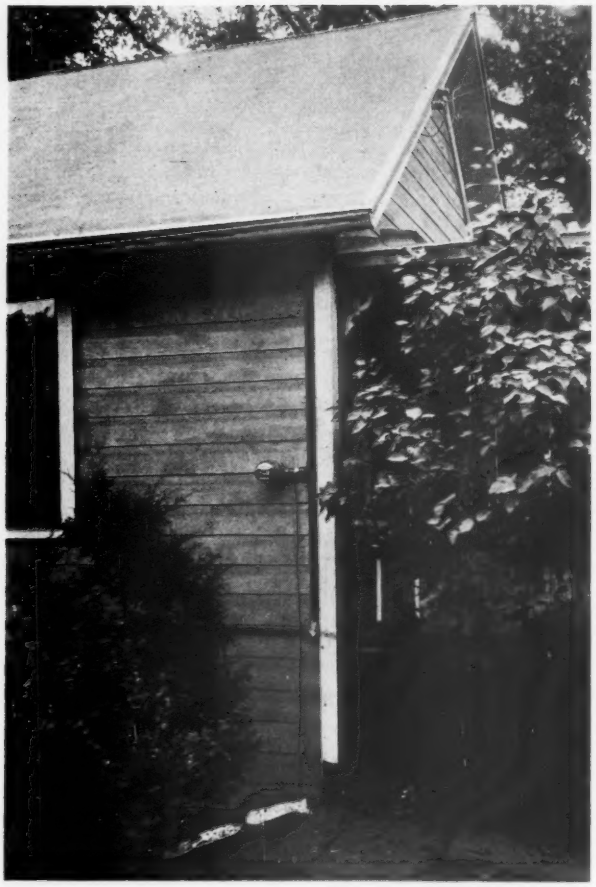

Fig. 1—Detachable type of outdoor meter. Location of this meter is considered undesirable.

Fig. 2—Location of these meters is also considered undesirable.

Fig. 3—Meter installed in weather-proof cabinet.

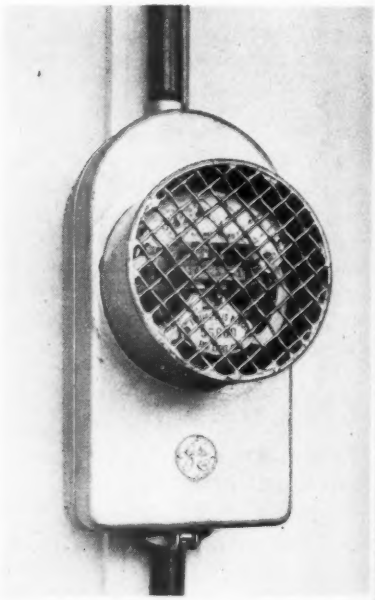

Fig. 4—Protective housing applied to an outdoor meter.

Fig. 5—A typical outdoor installation of a small group of detachable type meters located on an apartment house.

Fig. 7—Another installation of a meter in a weather-proof cabinet.

closure now available, costs being duly considered.

3. The number of component parts shall be at a minimum.
4. The enclosure shall be constructed of rust-resisting material, superior to that now generally used, and be free from pits, scale and other imperfections. Where a finish is required, it shall be baked enamel or equivalent. Preferably it should be gray or some other neutral color. The final product must be capable of taking, and holding in a satisfactory manner, the usual types of house paint. Exposure to the elements must not permit discoloration of the building to which it is attached.
5. The base of the enclosure shall be of minimum depth providing maximum accessibility to meter, test device, and wiring when cover is removed.
6. The cover shall be designed to completely enclose and adequately protect the equipment installed, and shall be provided with a window of minimum dimensions properly placed to permit easy reading of any meter which might be used. Window to be equipped with adequate gaskets fastened from the inside.
7. Means shall be provided to rigidly fasten both meter and test device to base of enclosure. Provisions for either insulated or uninsulated mounting of meters must be available.
8. If provision is made for conduit connection at the top, it shall be of the threaded type into which the conduit can be screwed. Provision should be made for covering such opening if this opening is not used. All openings at the sides, bottom or back may be of the usual knockout type accommodating up to 1¼ in. conduit.

(Continued on page 50)

Fig. 6—Indoor type of meter installed on a porch.

PERFORMANCE OF INSULATING OILS IN TRANSFORMERS*

During the latter part of 1926 the N.E.L.A. Insulating Oils Subject Committee inaugurated a program for testing insulating oils used in transformers and oil circuit breakers. The oil circuit breaker test program closed about January 1, 1930, and the results were published in N.E.L.A. publication No. 169, dated December, 1931. The transformer test program was continued for another two years and closed with the test data received during the first quarter of 1932. This report was prepared from the data secured from the transformers included in the test program and no reference will be made to the oil circuit breaker test data.

Samples of oil were taken by twenty operating companies distributed over the country, as shown in Tables I and II. Table III presents the transformers under study. Table IV lists all the types of oil included in the test program. Table V gives the characteristics of insulating oils included in the test program. These values were furnished by the equipment manufacturers or the oil refiners.

These samples were tested in specified operating company laboratories and the test data were collected and assembled in the form of comparative curves by a special subcommittee of the Insulating Oils Subject Committee. The report is based on an analysis of these data by members of the subject committee.

The report does not cover policy or legal aspects of application of oils to transformers. It covers only the results of tests.

However, the report should not be interpreted to open the door for operators to purchase oil upon specification indiscriminately from all refiners. Insulating oil requires very careful handling and only responsible refiners familiar with its special requirements are able to produce satisfactory insulating oil. Detailed statements prepared by two manufacturers of oil-filled electrical equipment expressing their views on this phase of the situation are included as Appendix B in the report on Performance of Insulating Oils in Circuit Breakers, N.E.L.A. publication No. 169.

PURPOSE

The purpose of the test program was:

1. To establish the interchangeability of insulating oils furnished by electrical equipment manufacturers for oil circuit breaker and oil insulated transformer use.

2. To prepare a specification for an insulating oil that would be suitable in all types of oil circuit breakers and oil insulated transformers.

3. To establish whether insulating oils furnished directly by responsible refiners, and meeting the requirements of an acceptable specification, can be used in all types of oil circuit breakers and oil insulated transformers.

CONCLUSIONS

1. The data summarized in this report would indicate that standard oils now

TABLE I

OPERATING COMPANIES PARTICIPATING IN THE N. E. L. A. INSULATING OILS TEST PROGRAM

1 Brooklyn Edison Company
2 Buffalo General Electric Company
3 Commonwealth Edison Company
4 Consolidated Gas, Electric Light and Power Company
5 Detroit Edison Company
6 Duquesne Light Company
7 Empire District Electric Company
8 Louisville Gas and Electric Company
9 New York and Queens Electric Light and Power Company
10 Northern States Power Company
11 Oklahoma Gas and Electric Company
12 Philadelphia Electric Company
13 Public Service Company of Colorado
14 Rochester Gas and Electric Company
15. St. Joseph Railway, Light, Heat and Power Company
16 San Joaquin Light and Power Corporation
17 Southern California Edison Company
18 Toledo Edison Company
19 Union Gas and Electric Company
20 West Penn Power Company

TABLE II

GENERAL SUMMARY

N.E.L.A. INSULATING OILS TEST PROGRAM

		No.
1	Participating Companies	20
2	Electrical Apparatus Manufacturers	7
3.	Trade Names of Oils Under Observation	15
4	Oil Refiners	8
5	Transformer Installations	104
6	Geographic Location of Participating Companies:	
	(a) California	2
	(b) Colorado	1
	(c) Illinois	1
	(d) Kentucky	1
	(e) Maryland	1
	(f) Michigan	1
	(g) Minnesota	1
	(h) Missouri	2
	(i) New York	4
	(j) Ohio	2
	(k) Oklahoma	1
	(l) Pennsylvania	3

TABLE III

OIL-INSULATED TRANSFORMERS INCLUDED IN THE N.E.L.A. OIL TEST PROGRAM

No.	Kv-a.	Voltage	φ	Mfgr.	Oil	Cooled	Company
1	780	4000–400	3	G. E.	Tr. 10	S. C.	Toledo Edison
2	833	63000–2300	1	M.	C. S.	S. C.	Oklahoma G. & El.
3	1250	22000–2300	1	G. E.	Pat. 7	S. C.	Duquesne Light
4	1250	22000–2300	1	G. E.	G. E. 10	S. C.	Duquesne Light
5	1250	22000–2300	1	G. E.	G. E. 10-C	S. C.	Duquesne Light
6	2000	33000–6600	1	W.	Wemco C	S. C.	Empire District El.
7	2000	13200–2300	1	W.	Wemco C	S. C.	Louisville G. & El.
8	2000	12000	3	B. B.	Wemco C	S. C.	Commonwealth Edison
8½	2000	12000	3	B. B.	A. C. 3	S. C.	Commonwealth Edison
9	2000	13200–1440	1	W.	Wemco A	S. C.	Northern States
10	5000	13200–2400	3	W.	Wemco B	S. C.	New York & Queens
10¼	7500	13200–2400	3	W.	S. T.	S. C.	New York & Queens
10½	5000	13200–66000	1	W.	Wemco A	S. C.	West Penn Power
11	6000	24100–2300	3	G. E.	G. E. 10	S. C.	Detroit Edison
12	7500	13200–2400	3	G. E.	G. E. 10	S. C.	New York & Queens
13	1000	13200–2300	1	G. E.	G. E. 10	W. C.	Northern States
14	1500	13200–2300	1	G. E.	G. E. 10	S. C.	Northern States
15	1500	36400–13200	1	W.	Wemco A	W. C.	Oklahoma G. & El.
16	1667	12210–4000	1	G. E.	G. E. 10	W. C.	P. S. Co. of Colorado
17	1667	12210–4000	1	G. E.	G. E. 10	W. C.	P. S. Co. of Colorado
18	2475	4000	3	G. E.	G. E. 10	W. C.	Toledo Edison
19	2810	21000–2300	3	Pgh.	Pat. 7	W. C.	Buffalo General El.
20	2810	22000–2300	3	G. E.	G. E. 10-C	W. C.	Buffalo General El.
21	3000	22000–11500	1	G. E.	G. E. 10	W. C.	Buffalo General El.
22	3000	66000–23000	1	A. C.	C. S.	W. C.	St. Joe Ry. L. H. & P.
23	3000	66000–23000	1	A. C.	Vac. H	W. C.	St. Joe Ry. L. H. & P.
24	3333	22000–2300	1	W.	Pat. 7	W. C.	Duquesne Light
25	3333	22000–2300	1	W.	Empire	W. C.	Duquesne Light
26	3333	22000–2300	1	W.	Wemco C	W. C.	Duquesne Light
27	4250	12000–200	3	G. E.	G. E. 10-C	W. C.	Commonwealth Edison
28	6000	11500–4150	1	G. E.	Tr. 21	W. C.	Rochester G. & El.
29	8500	24000–4800	3	G. E.	G. E. 10	W. C.	Detroit Edison
29½	12000	76200–11000	1	W.	Wemco A.	W. C.	West Penn Power
30	2000	22000–2300	3	W.	Empire	S. C.	Duquesne Light

*A report of the former Electrical Apparatus Committee, Engineering National Section, N.E.L.A. Prepared by the Insulating Oils Subject Committee, G. SUTHERLAND, *Chairman*.

TABLE III (Continued)

OIL-INSULATED TRANSFORMERS INCLUDED IN THE N.E.L.A. OIL TEST PROGRAM

No.	Kv-a.	Voltage	φ	Mfgr.	Oil	Cooled	Company
31	2000	22000–2300	3	W.	Wemco C	S. C.	Duquesne Light
32	2000	22000–2300	3	W.	Pat. 7	S. C.	Duquesne Light
33	2000	22000–2300	3	W.	Wemco C	S. C.	Duquesne Light
34	5000	120000–24000	1	W.	Wemco C	S. C.	Detroit Edison
35	5000	12000–2280	3	W.	Wemco C	S. C.	Commonwealth Edison
36	5000	59500–16500	1	W.	Wemco A	S. C.	Northern States
36½	5000	66000–13200	1	W.	Wemco C	S. C.	West Penn Power
37	7500	13200–2400	3	W.	Wemco B	S. C.	New York & Queens
38	10000	23000–4000	3	W.	Wemco A	S. C.	Toledo Edison
39	2000	22000–2300	1	M.	Vac. H	W. C.	St. Joe Ry. L. H. & P.
40	2000	22000–2300	1	M.	C. S.	W. C.	St. Joe Ry. L. H. & P.
41	7500	23000–4000	3	W.	Wemco A	W. C.	Toledo Edison
42	7500	12000–2280	3	W.	Wemco C	W. C.	Commonwealth Edison
43	7500	85800–13800	1	W.	Wemco C	W. C.	P. S. Co. of Colorado
43¼	10000	13200–38100	1	W.	Wemco C	W. C.	Union Gas & El.
43½	10000	13200–38100	1	W.	Wemco C	W. C.	Union Gas & El.
43¾	10000	13200–38100	1	W.	Wemco C	W. C.	Union Gas & El.
44	12500	12000–120000	1	W.	Wemco C	W. C.	Detroit Edison
44½	16667	76200–11000	1	W.	Wemco C	W. C.	West Penn Power
45	20000	40710–13800	1	W.	Wemco C	W. C.	Philadelphia El.
46	20000	40710–13800	1	W.	Wemco C	W. C.	Philadelphia El.
47	20000	40710–13800	1	W.	Wemco C	W. C.	Philadelphia El.
48	833	60600–13200	1	Pgh.	Pat. 7	S. C.	Oklahoma Gas & El.
49	2000	56000–8100	1	Wag.	Wag. E-6	S. C.	South Cal. Edison
49½	2500	25000–11000	1	Pgh.	Pat. C	S. C.	West Penn Power
50	3000	11000–2300	3	G. E.	Pat. 7	S. C.	Duquesne Light
51	3000	11000–2300	3	G. E.	G. E. 10-C	S. C.	Duquesne Light
52	3000	11000–2300	3	G. E.	Empire	S. C.	Duquesne Light
53	3000	11000–2300	3	G. E.	G. E. 10-C	S. C.	Duquesne Light
54	3000	38400–2300	1	G. E.	G. E. 10-C	S. C.	San Joaquin L. & P.
55	3333	38110–13200	1	G. E.	G. E. 10	S. C.	Louisville Gas & El.
56	3333	36400–13200	1	G. E.	G. E. 10	S. C.	Oklahoma Gas & El.
57	5000	120000–24000	1	G. E.	G. E. 10	S. C.	Detroit Edison
58	5000	11000–4150	3	W.	Wemco C	S. C.	Rochester Gas & El.
59	5000	12000–2300	3	Pgh.	Wemco C	S. C.	Commonwealth Edison
60	6000	69000–17245	3	G. E.	Tr. 10	S. C.	Toledo Edison
61	6000	11000–2300	3	Pgh.	Pat. 7	S. C.	Duquesne Light
62	6000	11000–2300	3	Pgh.	Wemco C	S. C.	Duquesne Light
63	7500	13200–2400	3	W.	Wemco B	S. C.	New York & Queens
64	7500	13200–2400	3	G. E.	G. E. 10	S. C.	New York & Queens
65	8333	36400–13200	1	W.	Wemco A	S. C.	Oklahoma Gas & El.
65⅛	8333	66000–7621–13200	1	G. E.	G. E. 10	S. C.	Union Gas & El.
65¼	8333	66000–7621–13200	1	G. E.	G. E. 10	S. C.	Union Gas & El.
65⅜	8333	66000–7621–13200	1	G. E.	G. E. 10	S. C.	Union Gas & El.
65½	8333	66000–7621–13200	1	G. E.	G. E. 10	S. C.	Union Gas & El.
65⅝	8333	66000–7621–13200	1	G. E.	G. E. 10	S. C.	Union Gas & El.
66	10000	26400–4560	3	G. E.	Tr. 10	S. C.	Brooklyn Edison
67	10000	13530–4400	3	G. E.	G. E. 10-C	S. C.	Consolidated Gas
68	10000	13600–4400	3	G. E.	G. E. 10-C	S. C.	Consolidated Gas
69	10500	60000–13100	1	W.	Wemco C	S. C.	Buffalo Gas & El.
70	7500	13200–2400	3	Pgh.	Pat. 7	S. C.	New York & Queens
70½	15000	26400–2400	3	G. E.	G. E. 10-C	S. C.	New York & Queens
71	20000	68500–13800	1	G. E.	Tr. 10	S. C.	Philadelphia El.
72	20000	68500–13800	1	G. E.	Tr. 10	S. C.	Philadelphia El.
73	20000	68500–13800	1	G. E.	Tr. 10	S. C.	Philadelphia El.
74	29667	15940–7970	1	W.	Wemco C	S. C.	Brooklyn Edison
75	2810	21000–2300	3	Pgh.	Pat. 7	W. C.	Buffalo General El.
76	3000	38100–16500	1	W.	Wemco C	W. C.	South Cal. Edison
77	4350	33000–6600	1	W.	Wemco C	W. C.	Empire District El.
78	5000	12000–2310	3	Pgh.	Wemco C	W. C.	Commonwealth Edison
78½	5000	25000–11000	1	Pgh.	Pat C.	W. C.	West Penn Power
79	7500	85800–13800	1	W.	Wemco A	W. C.	P. S. Co. of Colorado
80	10000	60000–11000	3	G. E.	Tr. 21	W. C.	Rochester Gas & El.
81	14000	38000–11500	3	G. E.	G. E. 10-C	W. C.	Buffalo General El.
82	15000	62400–13200	1	W.	Wemco A	W. C.	Northern States
83	20000	22250–11500	3	G. E.	G. E. 10-C	W. C.	Buffalo General El.
83½	25000	132000–12000	1	G. E.	Tr. 10	W. C.	Detroit Edison
84	66667	11500–23500	3	G. E.	G. E. 10-C	W. C.	Buffalo General El.
85	10500	63000–22650	1	W.	Wemco C	S. C.	Buffalo General El.

A.C.—Allis Chalmers
B.B.—Brown Boveri
C.S.—Cities Service
G.E.—General Electric
M.—Maloney Electric
Pat. C—Patria C
Pat. 7—Patria 7
Pgh.—Pittsburgh
S.C.—Self Cooled
S.T.—Socony Transil
Tr. 10—Transil 10
Vac. H—Vacuum H
Wag.—Wagner
W.—Westinghouse
W.C.—Water Cooled

supplied by electrical equipment manufacturers for transformer service would be suitable for use in any electrical apparatus manufacturer's modern oil-insulated transformer under comparable climatic conditions.

As a result of the preliminary work of the subject committee, the two largest American manufacturers of electrical equipment have agreed to the interchangeability of their oils in modern oil-insulated equipment when these oils have characteristics essentially the same as those of their own oils and when these oils are furnished by refiners approved by the electrical equipment manufacturers. The conditions of the agreement on interchangeability are given in detail in Appendix A.

2. The subject committee has prepared a suggested specification which is included in this report.

3. The results of the test indicate that the various trade-named oils meeting the suggested specification of the subject committee perform equally well in any modern type of oil-insulated transformer.

A number of refiners are meeting the requirements of the specification and a few companies are purchasing such oils directly from the refiner on a specification.

DISCUSSION

During the first three years of the test program complete test data were taken on all of the items discussed below, but since the tests under items 1 to 7 inclusive had no particular significance, it was decided by the Insulating Oils Subject Committee to discontinue these tests and collect the data on Neutralization Number and Dielectric Strength only.

The data which have not been tabulated in this report are available from the Subject Committee's files.

1. Specific Gravity, Flash, Fire, Pour and Viscosity

These tests were run primarily to check the oil used. No significant alterations in these values were observed during the test period. These data are available in the original reports, but are not shown in the graphic form of this report.

2. Sulphur Corrosion

The majority of the operating companies participating in the test program reported no sulphur corrosion in transformer oils during the test program. There were a few instances where sulphur corrosion was reported in qualitative terms of "trace" or "marked" but showed no definite trend. Sulphur cor-

rosion might be reported at the beginning of the test and disappear before the next oil sample was taken and not show up again during the remainder of the test program.

3. Unsaturated Hydro-carbons

No significance was given this test due to the fact that there was no definite trend regardless of the age of the oil.

4. Sediment by Volume

No significance was given this test because in the few instances where it was reported there was no relation between the values given for sediment by weight

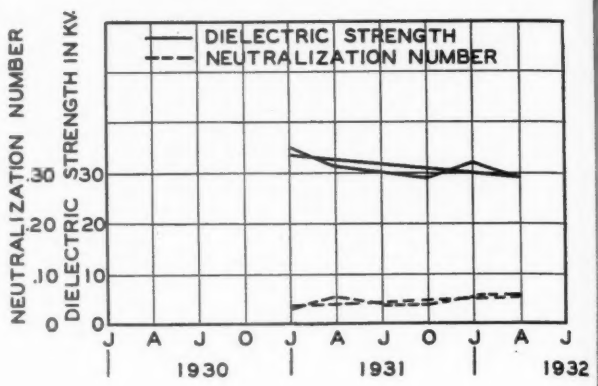

Fig. 1 — Allis Chalmers No. 3 Oil — Dielectric Strength and Neutralization — Average and Trend Curves.

TABLE IV

TRANSFORMER OILS INCLUDED IN THE TEST PROGRAM

Trade Name of Oil	Refiner	Manufacturer of Transformers in Which Oil Was Used During Tests
Allis Chalmers No. 3	Vacuum Oil	Brown Boveri
	Sun Oil	
	Standard Oil Company of Indiana	
Cities Service	Cities Service	Allis-Chalmers
		Maloney
Empire	Empire Refining	General Electric
		Westinghouse
G. E. 10	Vacuum Oil	General Electric
G. E. 10-C	Vacuum Oil	General Electric
Patria C	A. D. Miller & Sons	Pittsburgh
Patria 7	A. D. Miller & Sons	General Electric
		Pittsburgh
		Westinghouse
Socony Transil	Standard Oil Company of New York	Westinghouse
Transil No. 10	Vacuum Oil	General Electric
Transil No. 21	Vacuum Oil	General Electric
Vacuum H	Vacuum Oil	Allis-Chalmers
		Maloney
Wagner E-6	Empire Refining	Wagner
Wemco A	Vacuum Oil	Westinghouse
Wemco B	Vacuum Oil	Westinghouse
Wemco C	Vacuum Oil	Brown-Boveri
	Standard Oil Company of California	Pittsburgh
		Westinghouse

or the length of time the transformer oil was in service. The numerical value of the data reported is a crude approximation.

5. Life Test

Life test data were submitted by three separate operating companies on all of the transformers they had included in the test program. The data, in most cases, show 1 to 3 days' life at the beginning of the test program with very little change during the five years. This would indicate, as in the case of circuit breaker oils, that the transformer oils contained enough foreign material to destroy the significance of the test.

Other oils showed a higher life test at the beginning of the test program which dropped to 1 or 2 days after the test program had been in progress from six months to a year, and maintained this low value during the remainder of the program.

During the last two years of the test program, data from two special oils were

TABLE V

INSULATING OIL CHARACTERISTICS

Trade Name of Oil	Allis Chalmers No. 3	Empire	G. E. No. 10-C	G. E. No. 21	Patria C	Patria 7	Socony Transil	Vacuum H	Wagner E-6	Wemco C	Suggested NELA Specific'n
1. Flash Point—min. degree C.	132	135	133	155	135	140	172	132	138	132	130
2. Fire Point—min. degree C.	150	152	148	170	149	155	184	149	160	149	150
3. Pour Point—max. degree C.	–40	–50	–40	–40	–40	– 2	–48	– 1	–10	–45	–40
4. Viscosity, Saybolt, 37.8 C.—max. sec.	55–63	54	55	90	61	48	70	35–43	50	57	60
5. Neutralization No.—max.	0.03	0.03	0.02	0.02	0.05	0.05	0.02	....	0.1	0.03	0.05
6. Mineral Acids, Chloride and Sulphates	None	None	None	None	None	None	None	None	Not Specified	None	None
7. Free and Corrosive Sulphur	None	None	None	None	None	None	None	None	None	None	None
8. Sludge (Snyder Life Test)—min. days	20	18	....	....	....	....	....	....	20	....	18
9. Steam Emulsification Test—max. sec.	....	30	....	....	....	....	25	....	30	25	25
10. Dielectric Strength—min. Kv.	22	25	22	22	22	22	25	22	25	22	22

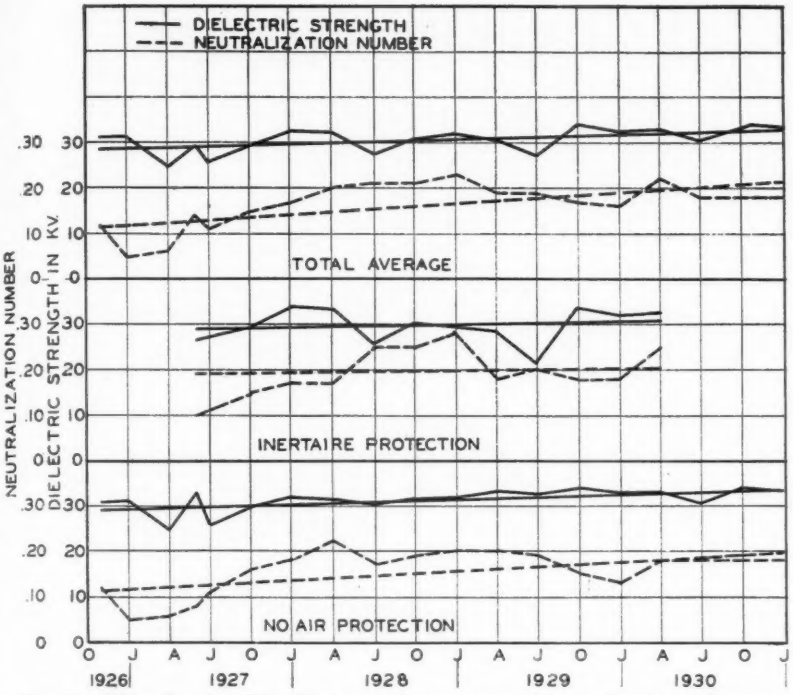

Fig. 2—Cities Service Oil—Dielectric Strength and Neutralization—Average and Trend Curves for Inertaire and No Air Protection.

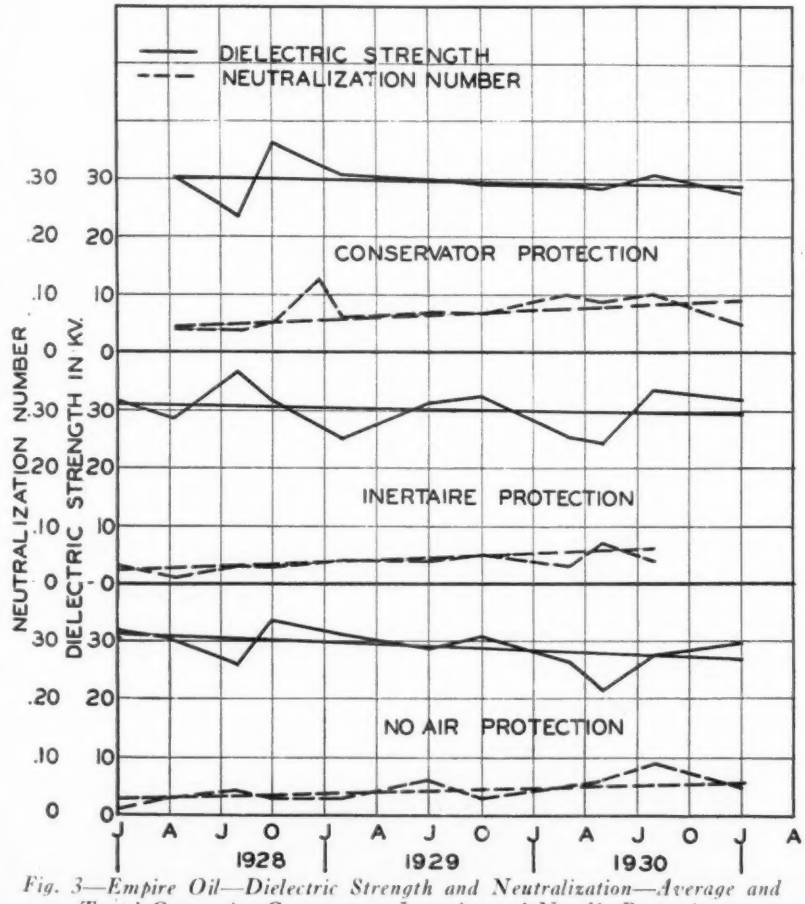

Fig. 3—Empire Oil—Dielectric Strength and Neutralization—Average and Trend Curves for Conservator, Inertaire and No Air Protection.

included. Allis Chalmers No. 3 oil maintained its life test at 7 to 9 days for 16 months under observation and the Socony Transil Oil life test dropped from 11 days to 9 days after the first year's service. During the second year of service this oil remained fairly constant at a life test of 7 days.

6. Sediment by Extraction

The data submitted show sediment present in all oils to varying degrees with no definite trend over the period of the test.

7. Precise Resistance to Emulsification A.S.T.M. Steam Emulsion Test

The data submitted for this test show very little change during the test period. This would indicate that the emulsification time for transformer oils is not affected by the length of time the oil is in service.

8. Neutralization Number

Considering all of the oils included in the test program, the total average trend curves of neutralization show relatively the same rate of rise for all oils with the exception of Patria "C" which has a very decided increase. This oil is included in only two conservator type transformers. There is a greater variation between the various trend curves for each type of oil protection. Excluding Patria "C" oil, the greatest variation in the trend curves of neutralization number is shown for the No Air Protection group. The variation between the trend curves of the Conservator Protection group and the Inertaire Protection group are practically the same.

9. Dielectric Strength

The total average trend curves show that the dielectric strength of the oil has been maintained above a safe operating value for the period of the test and there does not seem to be any definite connection between the acidity of the oil and the dielectric strength.

ANALYSIS PROCEDURE

The transformer oils included in the test program were divided into three general classes, depending upon the type of protection against oil oxidation used on the various transformers, namely,

1. Conservator Protection
2. Inertaire Protection
3. No Air Protection

The neutralization number and dielectric strength data were tabulated by the months of the year, from which an average curve for each type of air protection and a total average curve were plotted

for each oil. It was assumed that the trend of each of the average curves was a straight line and a trend curve was calculated from an equation derived by the least squares method of calculation.

The load and temperature data submitted were carefully analyzed to determine if possible whether there was any connection between the variation in dielectric strength and neutralization and the load or temperature. Several curves were plotted for individual transformers which show that the dielectric strength and neutralization number were not affected by the load or temperature within the temperature ranges developed by these tests.

All of the test data not included in this report are available from the files of the subject committee.

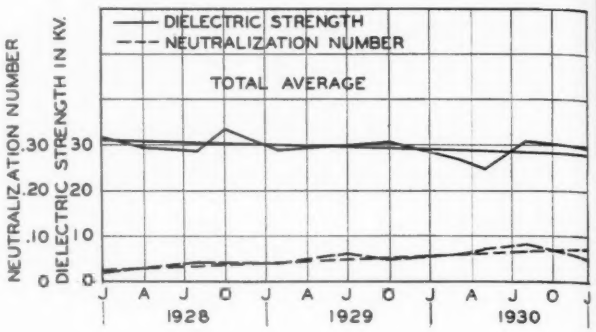

Fig. 4 — Empire Oil — Dielectric Strength and Neutralization — Total Average and Trend Curves.

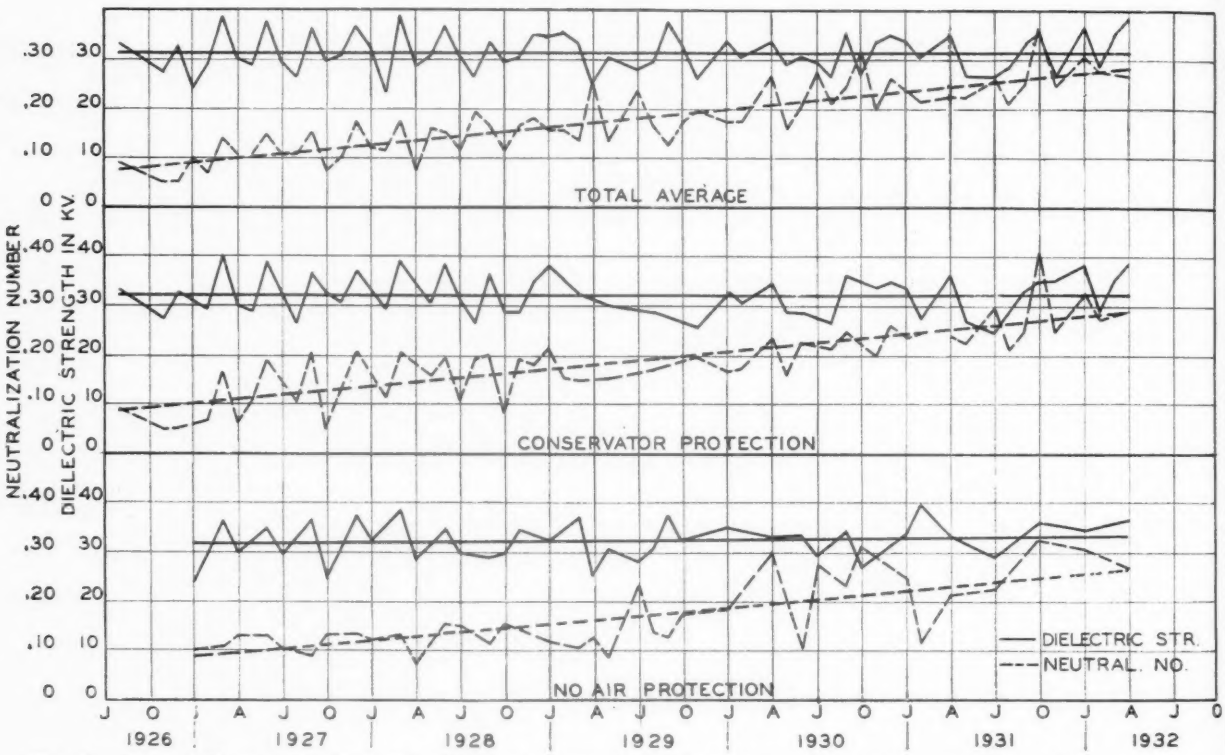

Fig. 5—General Electric Co. 10-C Oil—Dielectric Strength and Neutralization—Average and Trend Curves for Conservator and No Air Protection.

All of the test data not included in this report are available from the files of the subject committee.

TEST REFERENCES USED IN THE FIVE-YEAR PROGRAM

1. Specific Gravity
   A.S.T.M. D 47-24, p. 881
   A.S.T.M. Standards, 1924
2. Flash and Fire Test
   A.S.T.M. D 92-24, p. 517-521
   A.S.T.M. Standards, 1930
3. Pour Test
   A.S.T.M. D 97-30, p. 481-487
   A.S.T.M. Standards, 1930

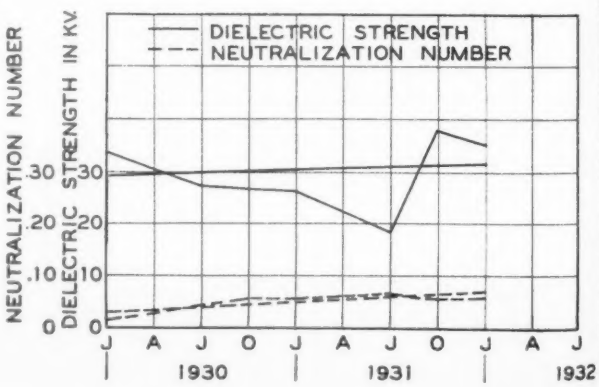

Fig. 6 — Socony Transil Oil — Dielectric Strength and Neutralization — Average and Trend Curves for No Air Protection.

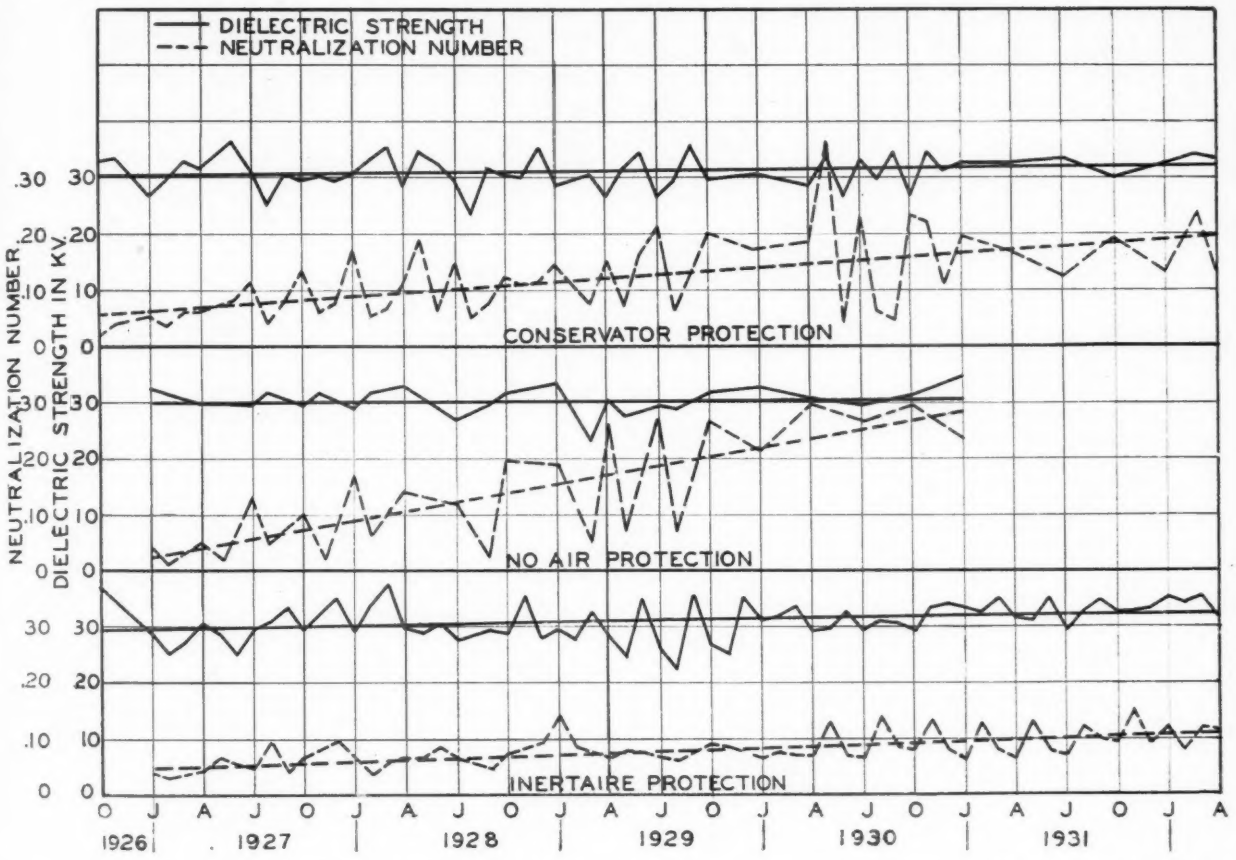
DIELECTRIC STRENGTH
NEUTRALIZATION NUMBER
CONSERVATOR PROTECTION
NO AIR PROTECTION
INERTAIRE PROTECTION
NEUTRALIZATION NUMBER
DIELECTRIC STRENGTH IN KV.
O J A J O J A J O J A J O J A J O J A J O J A
1926 1927 1928 1929 1930 1931

Fig. 7—Wemco C Oil—Dielectric Strength and Neutralization—Average and Trend Curves for Conservator, Inertaire and No Air Protection.

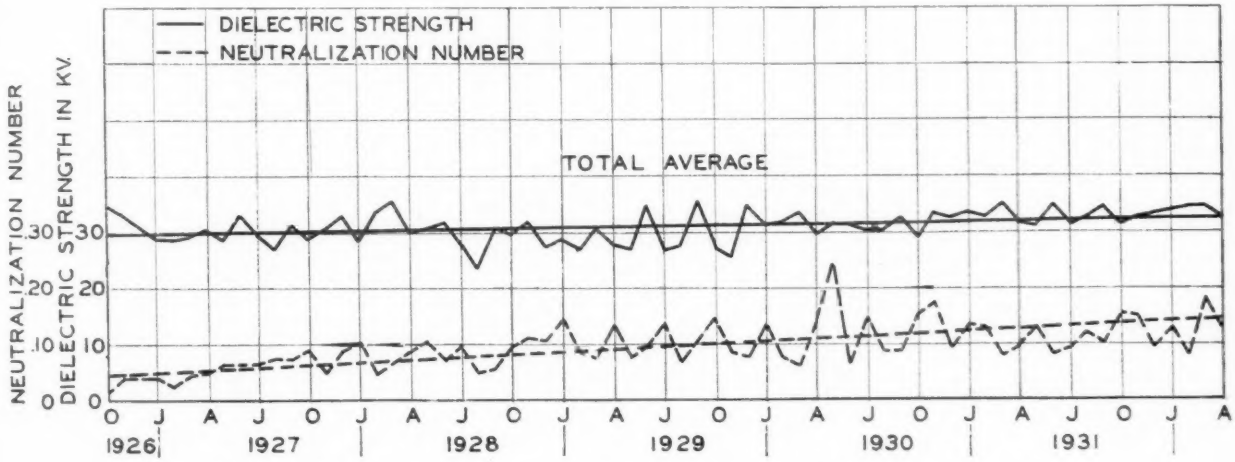
DIELECTRIC STRENGTH
NEUTRALIZATION NUMBER
TOTAL AVERAGE
NEUTRALIZATION NUMBER
DIELECTRIC STRENGTH IN KV.
O J A J O J A J O J A J O J A J O J A J O J A
1926 1927 1928 1929 1930 1931

Fig. 8—Wemco C Oil—Dielectric Strength and Neutralization—Total Average and Trend Curves.

4. Viscosity Tests
A.S.T.M. D 88-30, p. 550-555
A.S.T.M. Standards, 1930

5. Precise Resistance to Emulsification (Steam Emulsion Test)
A.S.T.M. D 157-28, p. 537-541
A.S.T.M. Standards, 1930

6. Sediment by Extraction
Technical paper No. 323-A, U. S. Government Specification for Lubricants and Liquid Fuels, and Methods for Testing
Specification No. 2-C, 1924, Government Printing Office, Washington, D. C.

7. Sediment by Volume
Technical paper No. 323-D, Method No. 300.31, p. 79
U. S. Government Master Specification for Lubricants and Liquid Fuel, 1927

8. Neutralization Number
A.S.T.M. D 188-27T, p. 426-428
A.S.T.M. 1931 Tentative Standards

9. Sulphur Corrosion
A.S.T.M. D 117-27, p. 1004-1011
A.S.T.M. Standards, 1930

10. Unsaturated Hydro-carbons
Technical paper No. 323-A, p. 89, Method No. 550.2 (See No. 6, Sediment by Extraction)

1 PATRIA 'C'	3 WAGNER 'E-6'	5 WEMCO 'B'	7. G.E. 10	9 PATRIA 7
2 TRANSIL 21	4 EMPIRE OIL	6 WEMCO 'C'	8 WEMCO 'A'	10 G.E. '10-C'

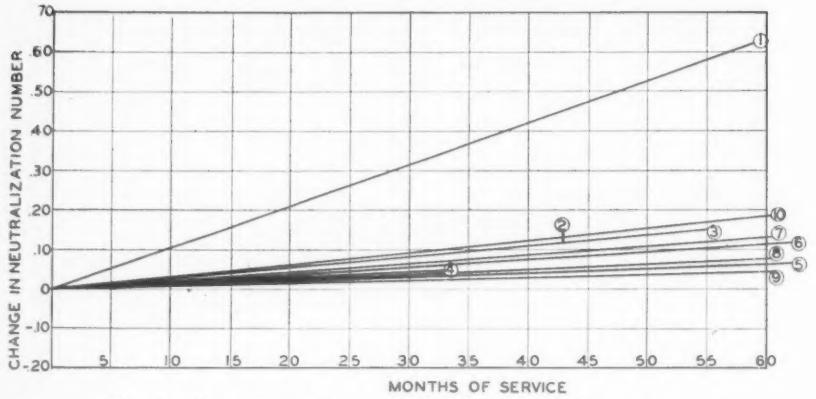

Fig. 9—Conservator Protection Neutralization Trend Curve.

1. CITIES SERVICE OIL	2. EMPIRE OIL	3. VACUUM 'H'	4. WEMCO 'B'	5. WEMCO 'C'	6. WEMCO 'A'

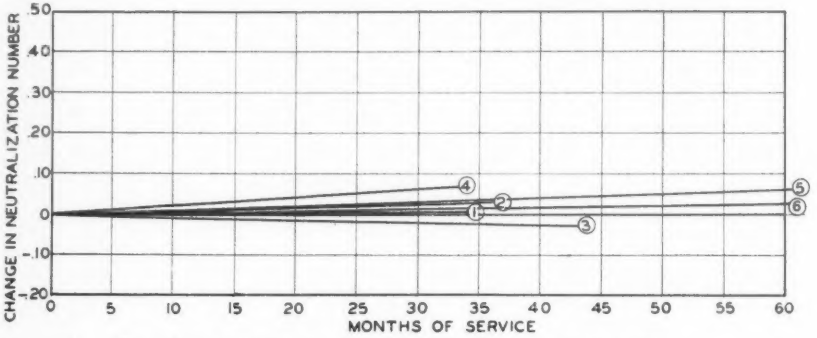

Fig. 10—Inertaire Protection Neutralization Trend Curve.

1. CITIES SERVICE	3. EMPIRE OIL	5. WEMCO 'B'	7. G.E. 10	9. PATRIA 7
2. TRANSIL 21	4. VACUUM 'H'	6. WEMCO 'C'	8. WEMCO 'A'	10. G. E. 10-C

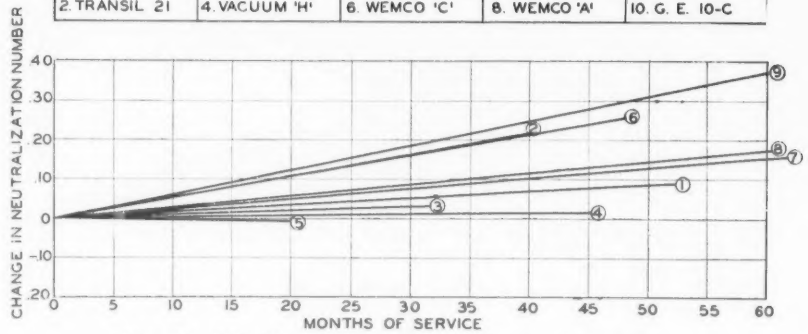

Fig. 11—No Air Protection Neutralization Trend Curve.

1. CITIES SERVICE	4. WAGNER E-6	7. WEMCO 'B'	10. WEMCO 'A'	13. SOCONY TRANSIL OIL
2. PATRIA 'C'	5. EMPIRE OIL	8. WEMCO 'C'	11. PATRIA 7	14. G. E. 10-C-SPEC.
3. TRANSIL 21	6. VACUUM 'H'	9. G. E. '10'	12. G. E. 10-C	15. ALLIS CHALMERS 3 OIL

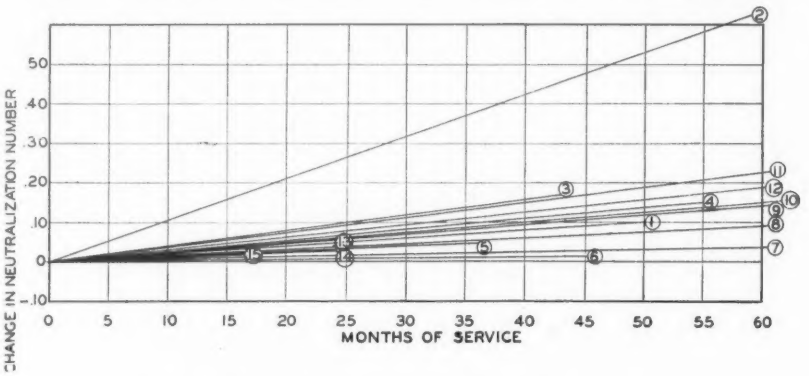

Fig. 12—Total Average Neutralization Trend Curves.

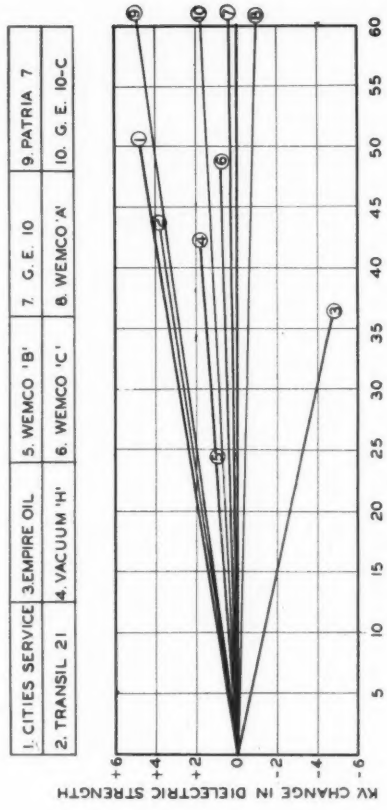

Fig. 15—No Air Protection Dielectric Strength Trend Curve.

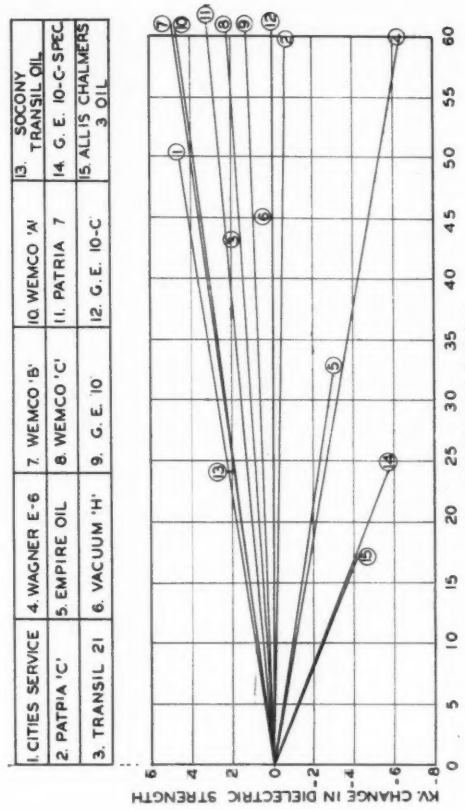

Fig. 16—Total Average Dielectric Strength Trend Curves.

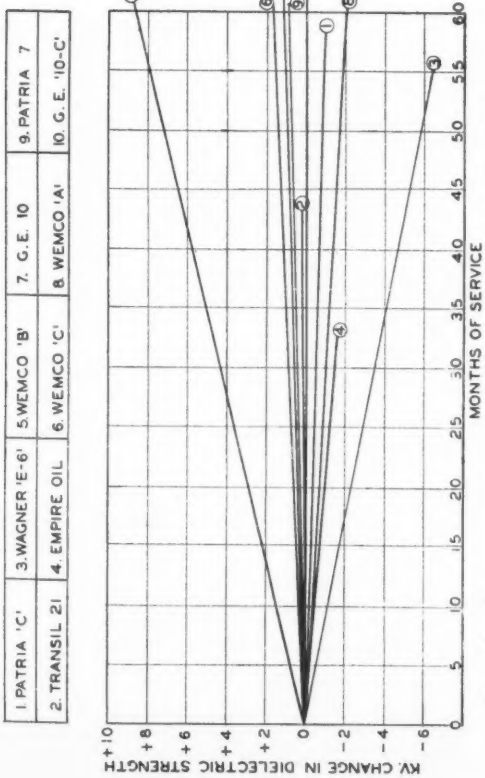

Fig. 13—Conservator Protection Dielectric Strength Trend Curve.

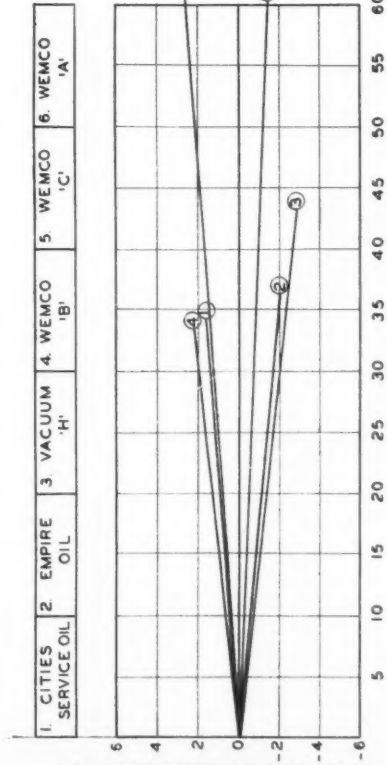

Fig. 14—Inertaire Protection Dielectric Strength Trend Curve.

11. Life Test (Snyder)

A.S.T.M. Proceedings 1927, p. 541

12. Dielectric Strength

A.S.T.M. D 117-27
A.S.T.M. Standards, 1930

A SUGGESTED SPECIFICATION FOR INSULATING OIL

1. Scope

The oil furnished in accordance with this specification will be used in all oil-immersed electrical devices for purposes of insulation and cooling. This specification will not cover oils used in cables and potheads.

The insulating oil shall be a pure mineral oil from which inorganic acids, alkalies and free sulphur shall be absent.

Oil purchased under this specification shall conform to the following requirements as determined by the test methods specifically noted.

2. Flash Point

The flash point shall be not less than 130°C as determined by Test Method D-92-24, A.S.T.M. Standards, 1930, Part II, p. 517.

3. Fire Point

The fire point shall be not less than 150°C as determined by Test Method D-92-24, A.S.T.M. Standards, 1930, Part II, p. 517.

4. Pour Point

The pour point shall be not higher than —40°C as determined by Test Method D-97-30, A.S.T.M. Standards, 1930, Part II, p. 481.

5. Viscosity

The viscosity shall be not greater than 60 sec. Saybolt at 37.8°C as determined by Test Method D-88-30, A.S.T.M. Standards, 1930, Part II, p. 550.

6. Neutralization Number

There shall be required not more than 0.05 mg. of potassium hydroxide to neutralize 1 g. of the oil as determined by Test Method D-188-27-T, A.S.T.M. Tentative Standards, 1930, p. 378.

7. Mineral Acids (Chlorides and Sulphates)

The oil shall show the absence of mineral acids (chlorides and sulphates) as determined by Test Method D-117-27, A.S.T.M. Standards, 1930, Part II, p. 1008.

8. Free and Corrosive Sulphur

The oil shall not contain free sulphur or corrosive sulphur compounds as determined by Test Method D-117-27, A.S.T.M. Standards, 1930, Part II, p. 1008.

9 Sludge

A deposit of sludge shall not be visible until a sludge test has been continued for at least 18 days in accordance with the Snyder Life Test as published in Appendix to Report of Committee D-9, 1927 Proceedings, A.S.T.M., Part I, p. 541.

10. Steam Emulsion Test (Precise Resistance to Emulsification)

The S. E. number of the insulating oil shall not exceed 25 sec. as determined by Test Method D-157-28, A.S.T.M. Standards, 1930, Part II, p. 537.

11. Dielectric Strength

The dielectric strength shall be not less than 22 kv as determined by Test Method D-117-27, A.S.T.M. Standards, 1930, Part II, p. 1009.

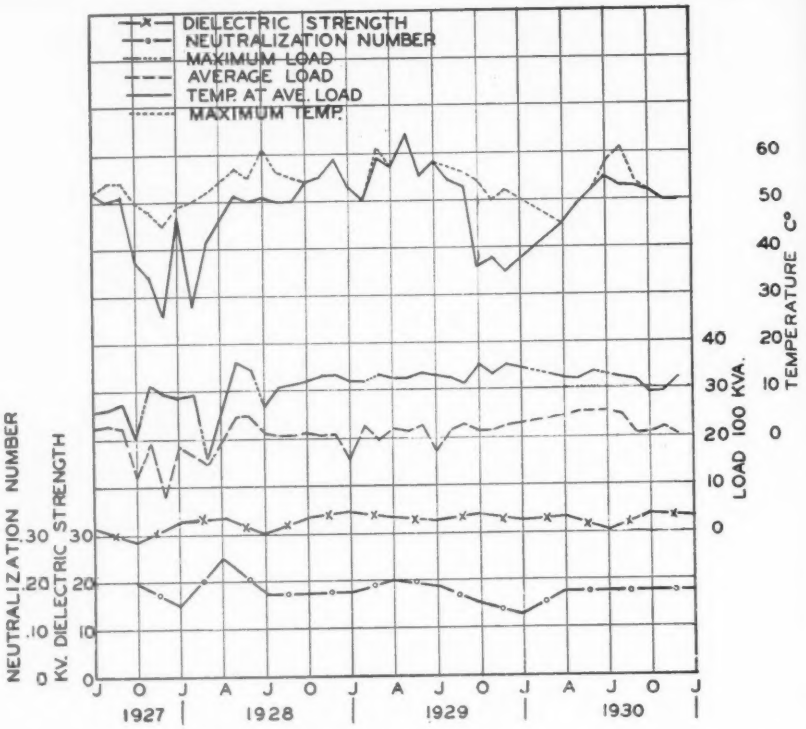

Fig. 17—Relation of Loading and Oil Temperature to Dielectric Strength and Neutralization—Test Program No. 22—Allis Chalmers 3,000 K-va—No Air Protection—O.I.W.C. Transformer—Cities Service Oil.

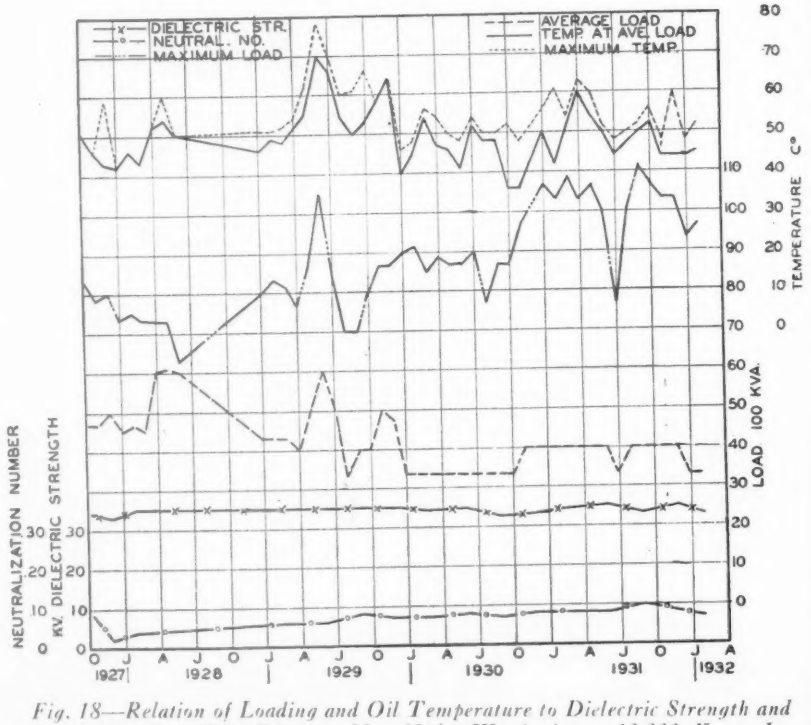

Fig. 18—Relation of Loading and Oil Temperature to Dielectric Strength and Neutralization—Test Program No. 43¼—Westinghouse 10,000 K-va—Inertaire Protection—O.I.W.C. Transformer—Wemco C Oil

12. Sampling Methods

The oil sampling procedure for these tests shall conform to the methods outlined in D-117-27, A.S.T.M. Standards, 1930, Part II, p. 1004.

13. Determination of Quantities

It is established that 60°F is the normal temperature for all oil to be delivered under this specification. Deductions shall be made and additions shall be made to the apparent quantity of oil contained in any delivery in accordance with the Standard Abridged Volume Correction Table for Petroleum Oils, D-206-25, A.S.T.M. Standards, 1930, Part II, p. 447. The temperature of the oil shall be made at time of volume measurement.

14. Acceptance Tests

Proposed bidders shall submit a 2-quart sample in a glass container of the oil proposed in the bid.

Each shipment of oil will also be tested by the purchaser after sampling at point of delivery. Oil which fails to comply with any one or all of the limits specified will be rejected and must be removed by the vendor who shall pay all expenses of delivery and removing the rejected oil.

APPENDIX A

Westinghouse and General Electric Companies' Agreement on Interchangeability of Insulating Oil As It Affects Transformers*

The Westinghouse and General Electric Companies have agreed to the interchange of WEMCO-C and GE 10-C oils in transformers when supplied by approved refiners. The General Electric Company will approve the use of WEMCO-C in transformers with the understanding that WEMCO-C oil as regularly supplied by the Westinghouse Electric & Manufacturing Company has characteristics essentially the same as General Electric 10-C and that their specifications and supervision compare favorably with those under which General Electric 10-C is supplied. The Westinghouse Electric & Manufacturing Company will approve the use of General Electric 10-C oil in all transformers provided that the General Electric 10-C is furnished by refiners acceptable to the Westinghouse Electric & Manufacturing Company.

Both manufacturers have agreed to mixing WEMCO-C and GE 10-C oils on the same basis as that specified for interchangeability described in the foregoing.

The General Electric Company does not consider it advisable to use in transformers No. 10-C oil which has been previously used in oil circuit breakers even though the oil has been reconditioned by a centrifuge or a filter press. Tests indicate that 10-C oil subjected to arcs in oil circuit breakers show an increased tendency to oxidize and produce sludge under the aggravated conditions of higher operating temperatures encountered in transformer operation.

The Westinghouse Electric & Manufacturing Company has announced that the WEMCO-C oil may be used in transformers after arcing in circuit breakers, provided all carbon is removed and the purified oil meets the following values:

Specific Gravity at 15.5°C., .898 Max.
Viscosity, Saybolt at 40°C. (104°F.), 59 Secs. Max.
Flash Point, 132°C. (270°F.) Min.
Pour Test, −45.6°C. (−50°F.) Max.
R. E. Number, 35 Secs. Max.
Neutralization Number—Mg. KOH per gram of oil, 0.08 Max.
Corrosive Sulphur, None
Dielectric Strength (1" dia. discs, space 1/10" apart) 22 K.V. Min.

* For statement on agreement of interchangeability of insulating oil in oil circuit breakers see Appendix A, page 7, N.E.L.A. Report No. 169, "Performance of Insulating Oils in Circuit Breakers."

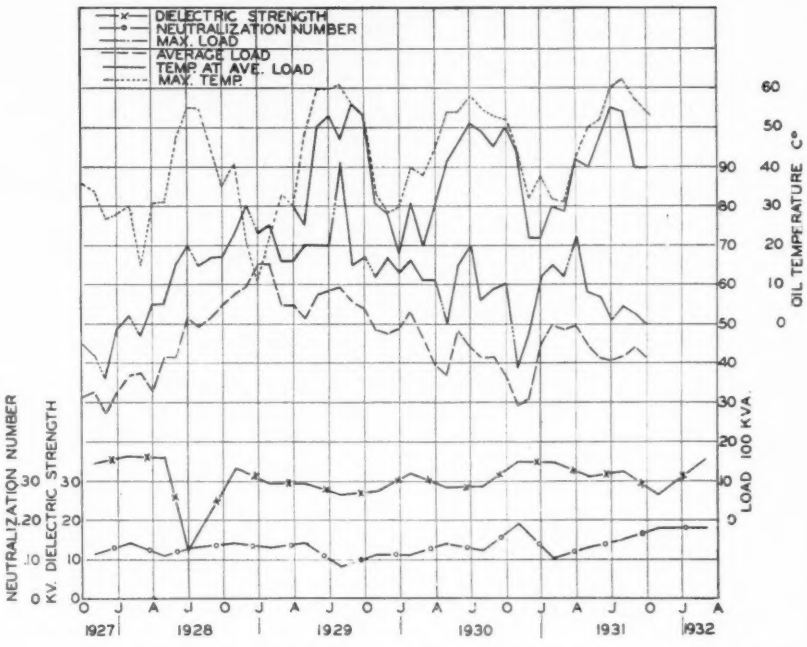

Fig. 19—Relation of Loading and Oil Temperature to Dielectric Strength and Neutralization—Test Program No. 57—General Electric 5,000 K-va—Conservator Protection—O.I.S.C. Transformer—G. E. No. 10 Oil.

IMPEDANCE CHARACTERISTICS OF COPPER-COVERED-STEEL CONDUCTORS

(Continued from page 32)

could be determined more accurately by a direct measurement. The method used was to place a fine insulated wire on the surface of the sample with the two conductors connected at one end. The actual voltage drop along the conductor, which defined the internal impedance, was then determined by a measurement between the insulated wire and the specimen.

The tests indicated that the average a-c resistance at 60 cycles was within about 10 per cent of the calculated d-c resistance. Through a current range of from about 5 to 200 amperes, the effective a-c resistance increased only about 10 per cent. The effective permeability of the samples varied from about 2 to 8. The lower values were for stranded conductors which included one or more solid copper wires in the makeup. These conclusions are based on 10 different sizes of cables, part of which were 30 and part 40 per cent conductivity. In addition, measurements were made on 6 samples of composite cable, that is, cables which contain hard-drawn copper wires, in addition to the copper-covered-steel wire.

The results of these tests are not in agreement with the only other available data. The reason for the difference in results is not known, since the exact composition of the conductors on which the older tests were based is not available. It is possible that the difference in material and method of manufacture accounts for the difference in characteristics. A summary of these results is given in the table.

STATISTICAL DATA OF THE ELECTRIC LIGHT AND POWER INDUSTRY

Compiled Monthly by the Edison Electric Institute—Covers 100% of the Industry

DURING THE MONTH OF MARCH

	1933	1932	%
Kilowatt-hours Generated* (net)			
By fuel	3,368,206,000	3,895,141,000	−13.5
By water power	2,797,897,000	2,825,705,000	− 1.0
Total kilowatt-hours generated	6,166,103,000	6,720,846,000	− 8.3
Additions to Supply			
Energy purchased from other sources	146,878,000	192,977,000	−23.9
Net international imports	29,881,000	46,538,000	−35.8
Total	176,759,000	239,515,000	−26.2
Deductions from Supply			
Energy used in electric railway depts.	61,462,000	84,984,000	−27.7
Energy used in electric and other depts.	99,119,000	103,693,000	− 4.4
Total	160,581,000	188,677,000	−14.9
Total energy for distribution	**6,182,281,000**	**6,771,684,000**	**− 8.7**
Energy lost in transmission, distribution, etc.	1,304,597,000	1,293,540,000	+ 0.9
Kilowatt-hours sold to ultimate consumers	**4,877,684,000**	**5,478,144,000**	**−11.0**
Sales to Ultimate Consumers (Kw-hrs)			
Domestic service	1,003,801,000	1,037,351,000	− 3.2
Commercial—Small light and power (retail)	984,337,000	1,085,400,000	− 9.3
Commercial—Large light and power (wholesale)	2,221,155,000	2,637,029,000	−15.8
Municipal street lighting	196,157,000	210,812,000	− 7.0
Railroads—Street and interurban	361,043,000	408,336,000	−11.6
Railroads—Electrified steam	54,527,000	49,346,000	+10.5
Municipal and miscellaneous	56,664,000	49,870,000	+13.6
Total sales to ultimate consumers	4,877,684,000	5,478,144,000	−11.0
Total revenue from Ultimate Consumers	$142,487,100	$157,142,000	− 9.3

DURING TWELVE MONTHS ENDING MARCH 31st

Kilowatt-hours Generated* (net)			
By fuel	44,399,196,000	54,891,825,000	−19.1
By water power	30,612,016,000	29,425,862,000	+ 4.0
Total kilowatt-hours generated	75,011,212,000	84,317,687,000	−11.0
Purchased energy (net)	2,664,070,000	2,837,886,000	− 6.1
Energy used in electric railway and other depts.	2,012,240,000	2,299,477,000	−12.5
Total energy for distribution	**75,663,042,000**	**84,856,096,000**	**−10.8**
Energy lost in transmission, distribution, etc.	13,610,448,000	14,149,864,000	− 3.8
Kilowatt-hours sold to ultimate consumers	**62,052,594,000**	**70,706,232,000**	**−12.2**
Total Revenue from Ultimate Consumers	$1,788,793,400	$1,953,358,400	− 8.4
Important Factors			
Percent of energy generated by waterpower	40.8%	34.9%	.....
Average pounds of coal per kilowatt-hour	1.49#	1.50#	.....
Domestic Service (residential use)			
Average annual consumption per customer (kw-hr)	596	588	+ 1.3
Average revenue per kw-hr (cents)	5.58¢	5.71¢	− 2.3
Average monthly bill per domestic customer	$2.77	$2.80	− 1.1

BASIC INFORMATION AS OF MARCH 31st

Generating Capacity (kw)—Steam	24,044,500	24,105,000
—Water power	8,967,500	8,876,300
—Internal combustion	457,900	446,200
Total generating capacity in kilowatts	33,469,900	33,427,500
Number of Customers		
Farms in Eastern Area (Included with Domestic)	(502,778)	(497,143)
Farms in Western Area (Included with Com'l—Large)	(203,337)	(206,258)
Domestic service	19,730,932	20,043,457
Commercial—Small light and power	3,657,532	3,731,021
Commercial—Large light and power	521,427	552,445
All other ultimate consumers	72,194	63,944
Total ultimate consumers	23,982,085	24,390,867

* By courtesy of the U. S. Geological Survey with deductions for certain plants not considered Electric Light and Power Enterprises.

POWER SALES ITEMS

AIR CONDITIONING

"Science Reverses Refrigeration Cycle and Gives Us . . . The Heat Pump!" C. D. Graham and G. Wilkes. Domestic Engineering, March, 1933, pp. 55-6 and 65. Engineering Publications, Inc., 1900 Prairie Ave., Chicago, Ill.

Heating buildings by means of reversed refrigeration cycle; latest developments in field of heating and cooling through use of refrigeration equipment; test installations by Westinghouse Electric & Manufacturing Co., in existing homes under actual operating conditions; diagram showing heat pump arranged for heating or cooling and humidifying.

"Summer Air Conditioning With Gas Heat Energy," E. D. Milener. American Gas Association Monthly, March, 1933, pp. 85-9. American Gas Association, Publisher, 420 Lexington Avenue, New York City.

Report on group of research residences; tests were conducted to determine cost of completely conditioning whole residences in summer to secure reaction of typical home owners to service rendered, and to secure operating data and operating experience with automatic, central, residential, gas-operated summer air-conditioning plants.

"Science of Air Conditioning," Ice & Cold Storage, April, 1933, pp. 66-7., Ice & Cold Storage, 35 Foster Lane, Cheapside, London E. C. 2, England.

Abstract of air conditioning course given by University Extension Division of Rutgers University, New Brunswick, N. J.; fundamentals and definitions; dry and wet bulb thermometers; psychrometric chart and its uses. (To be continued.)

"Air Conditioning Costs Analyzed," G. E. Zelhart. Electrical West, April, 1933, pp. 119-21. McGraw-Hill Publishing Co., 883 Mission St., San Francisco, Cal.

From experiences with its own building, air conditioned 9 years ago, San Joaquin Light & Power Corp., furnishes comprehensive data on operating costs and economics.

"Unit System Cools Large Dallas Store." Power, March, 1933, pp. 132-33. McGraw-Hill Publishing Co., 330 W. 42nd St., New York City.

Neiman Marcus Style Shop, Dallas, Tex., occupies a 4-story building with ground area of 20,680 sq. ft. and an adjoining 2-story building with ground floor area of 2,600 sq. ft. The refrigerating equipment consists of two 115 ton, 10 x 10 in. vertical ammonia compressors, belt-driven by 125 hp. synchronous motors. Total connected motor load of the refrigerating system is 355 hp. During the weather conditions indicated by the 3 p. m. readings in the table, 98°D.B.-75°W.B., less than 80% of the total motor horsepower was being used.

"40 Years Younger Through Modernization-Historic Grand Theatre Installs Up-to-Date Plant within Original Walls," N. C. Ebaugh, Assistant Professor of Mechanical Engineering, Georgia School of Technology. Southern Power Journal, March, 1933, pp. 4-8. W. R. C. Smith Publishing Co., Grant Building, Atlanta, Ga.

Grand Theatre, Atlanta, Georgia

Seating capacity 2,052

New air conditioning equipment:

Main Fan	50	Hp.	
Exhaust Fan	3	"	
Exhaust Fan	1	"	
Exhaust Fan	1½	"	
Exhaust Fan	½	"	
Exhaust Fan	1½	"	
		Fans	57½ Hp.
Air Washer Pump	25	Hp.	
Vacuum Pump	5	"	
Cooling Water Pump	40	"	
Sump Pump	2	"	
House Pump	7½	"	
		Pumps	79½ Hp.
Compressor	200	Hp.	
Exciter	7½	"	
		Compressor	207½ Hp.
Elevator M.G. Set	60	Hp.	
		Total	344½ Hp.

= .168 hp. per seat, exclusive of elevator.

"Air Conditioning for Comfort and Health," E. Harrington. General Electric Review, April, 1933, pp. 166-76. General Electric Co., publisher, Schenectady, N. Y.

Growth and development; requirements for comfort and health; temperature control; humidity control; control of air movement; control of air purity; air conditioning system; concerning future; various tables and curves.

BREWERIES

"Brewery Refrigeration," D. Mettier. Ice & Cold Storage, April, 1933, pp. 57-8. Ice & Cold Storage, 35 Foster Lane, Cheapside, London E. C. 2, England.

Malt cooling; cooling hop store; cooling yeast store; precooling of wort; subsequent cooling of wort; removing heat of fermentation, cooling fermented wort; cooling storage cellar; cooling decanting and beer cellars; ice manufacture. From Escher-Wyss News.

"Refrigeration for 1933 Breweries," Fred Ophuls and A. B. Stickney, President and Engineer, Fred Ophuls & Associates, Inc. Power, March, 1933, pp. 119-20. McGraw-Hill Publishing Co., 330 W. 42nd St., New York City.

While no exact typical requirements for refrigeration in a brewery can be set up, in order to give a general picture, the following figures, based on a 165,000 bbl. brewery in the tropics for which power requirements were given last month, are here included. With two 76-ton machines, each with capacity control, operation of one would suffice for all but about 100 days, leaving a spare for all times except peaks.

"Refrigeration in Modern Brewery," F. Ophuls. Power Plant Engineering, April, 1933, pp. 175-7. Technical Publishing Co., Monadnock Block, 53 W. Jackson Blvd., Chicago, Ill.

Basic brewing methods depend upon proper control of temperature which is made possible by refrigerating machinery.

"Thermal Engineer in Brewery," F. Ophuls and A. B. Stickney. Ice and Refrigeration, April, 1933, pp. 249-52. Nickerson & Collins Co., publisher, 435 N. Waller Ave., Chicago, Ill.

First of series of articles; description of brewing process; raw materials; preparation of wort; fermentation of finished wort; ageing of beer; preparing beer for shipment.

BY-PRODUCT POWER

"By-product Power Designs Must Be Tailored to Meet Local Conditions," M. K. Bryan, Chas. T. Main, Inc., Engineers, Boston, Mass. Power, March, 1933, pp. 116-117. McGraw-Hill Publishing Co., 330 West 42nd St., New York City.

The economics of by-product power installations are materially affected by these conditions and by the installation's physical surroundings. Among the more important of these factors are:

(a) The cost of the power which will be displaced by the contemplated installation. (By-product power can be produced for 5,000 to 7,000 B.t.u. per kwh., or say, fuel cost of 0.8 to 1.25 mills. The principal element of cost is the fixed charge on the capital invested.)

(b) The physical characteristics, both structural and economic, of all steam and power-generating equipment installed in the property.

(c) The load curves of power and of process steam.

(d) Other sources of power and the cost of power taken from or delivered to them. (It may be necessary to supplement the contemplated by-product power supply, or a surplus of by-product power may be available for sale after the plant load is supplied.)

COMPRESSORS

"Rotary Compressors." Ice & Cold Storage, March, 1933, pp. 39-40. Ice & Cold Storage, 35 Foster Lane, Cheapside, London E. C. 2, England.

Design of unit produced by Vilter Manufacturing Co., Milwaukee, Wis., obviating excessive friction and wear; advantages of two-stage compression; constructional details; special features.

DIESEL ENGINES

"More Power for Rockville Center Diesel Municipal Plant." Diesel Power, April, 1933, pp. 166-9. Business Journals, Inc., Publisher, 192 Lexington Ave., New York City.

Gives description of installation of 2,865 hp., four cycle, engine. Said to be the largest engine of its size in the country; also, this plant claimed to be the largest Diesel municipal plant in the United States. Some operating costs are given.

"Novel Cooling System at Rockville Center." Diesel Power, April, 1933, pp. 170-2. Business Journals, Inc., Publisher, 192 Lexington Ave., New York City.

Layout of cooling system of Rockville Center municipal Diesel Plant supplying adequate cooling water to 7465 hp. of Diesel engines.

ELECTRIC vs. STEAM POWER

"Electric vs. Steam Power in Michigan Mines." Electrical World, Jan. 21, 1933, pp. 108-9. McGraw-Hill Publishing Co., 330 W. 42nd St., New York City.

ICE PLANTS

"The Power Sales Problem of the Manufactured Ice Industry," Peter F. Loftus. Ice and Refrigeration, April, 1933, p. 246. Nickerson & Collins Co., Publisher, 435 N. Waller Ave., Chicago, Ill.

The paper presented at Annual Convention of Pennsylvania Ice Producers Association held at Harrisburg, Pa., March 21 and 22, 1933, in which he advocates customer's cost of supplying own service as basis of utility rates. Also points out that power cost study is necessary to application for lower rates.

MOTORS

"Fitting Motors and Clutches to High-Inertia Loads," R. S. Elberty, General Engineering Dept., Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Electrical World, Jan. 21, 1933, pp. 92-4. McGraw-Hill Publishing Co., 330 W. 42nd St., New York City.

PIPE LINE PUMPING

"New Rannett Pump Is Successful." Pipe Line News, April, 1933, pp. 10-13. Oildom Publishing Co., 1217 Hudson Blvd., Bayonne, N. J.

Descriptive and test data on 700 hp., 3 phase, 2300 volt, 3600 r.p.m. induction motor direct connected to eight stage centrifugal pump invented by D. Moran and E. O. Bennett for use on Great Lakes Pipe Line Co.'s gasoline line at Paradise, Mo.; much of data is derived from Conoco magazine and from paper by F. G. Richardson in Electrical World, dates not specified.

"New Pump Increases Advantages of Electric Power for Pipe Lines." Electrical World, March 18, 1933, pp. 358-60. McGraw-Hill Publishing Co., 330 W. 42nd St., New York City.

Calculations showed that capacity increase of 45% could be expected by Great Lakes Pipe Line Co. in its gasoline pipe line when certain new type of pumping unit went into operation as booster, or secondary pump, in line Oct. 1, 1932, at Paradise, Mo.; in four months' experience with first "Rannett" outdoor unit in regular service better than expected performance is attained; new type of electric rate also proves satisfactory.

"Atlantic Operating First Electric Generating Type Pipe Line Station," Lester M. Goldsmith, vice-president, Atlantic Pipe Line Co., Philadelphia, Pa. The Petroleum Engineer, February, 1933, pp. 19-21. Petroleum Engineer Publishing Co., 405 Tower Petroleum Bldg., Dallas, Tex.

There are two Ingersoll-Rand, Type "MG" 11¼ in. by 15 in. Diesel engines, developing 350 hp. each at 400 r.p.m. Each engine is directly connected to a General Electric generator, Type ATI, 225 kw. at 0.9 power factor, having a General Electric exciter, Type MPL, 20 kw., overhung and connected to the shaft extension of the generator. In this station there are two Byron Jackson pumps, rated at 29,500 bbl. per day, each direct connected to a 250 hp. General Electric motor, Type FT, 3 phase, 60 cycle, 2300 volt, operating at 3540 r.p.m.

POWER FACTOR

"This Thing Called Power Factor—VI." Power Plant Engineering, April, 1933, pp. 178-81. Technical Publishing Co., Monadnock Block, 53 W. Jackson Blvd., Chicago, Ill.

Effect of load on induction motor upon power factor; use of vector diagrams to show only induction motor load affects power factor calculations.

"High Speed Diesel Engine as Prime Mover for Pumping Stations," E. Earl. New England Water Works Association Journal, March, 1933, pp. 61-72 (discussion) 72-3; New England Water Works Association, 714 Tremont Temple, Boston, Mass. See also American City, April, 1933, pp. 46-8. American City Magazine Corp., 470 Fourth Ave., New York City.

Origin of Diesel engine; definition of true Diesel cycle; efficiency of Diesel engine; cost comparisons; some advantages of high speed Diesels; problem of combustion in Diesel engines; fuel injection system of Diesel engines; fuel for Diesel engine.

STEAM-DIESEL PLANTS

"Steam-Diesel Possibilities in Boston Post Office," E. J. Kates. Power, March, 1933, pp. 122-3. McGraw-Hill Publishing Co., 330 W. 42nd St., New York City.

Author agrees with viewpoint of D. D. Eames, whose recent article showed that it would be cheaper to generate necessary heat and power requirements than to purchase, but differs in that he believes that a steam-Diesel plant would save more money than the steam installation which Mr. Eames proposed.

OUTDOOR METER INSTALLATIONS

(*Continued from page 35*)

9. The supports or hangers shall be so constructed as to permit an air space between the cabinet and the surface upon which it is mounted.
10. The disconnect and/or test facilities shall be of simple construction and of minimum size, and be arranged on the meter side for the same sequence as the meter terminals, and shall provide 60 or 100 ampere capacity for three-wire, 230-volt service in the same space and mountings. All solder lugs for connection of leads to and from disconnect and/or test facilities should preferably be eliminated.
11. Provision shall be made for conveniently and satisfactorily connecting the neutral conductor and ground wire to the base of the enclosure.
12. Adequate mechanical provision shall be made to fasten cover securely in place. It should also have sealing facilities for application of the types of seals now in general use, including a small size padlock. It shall be impossible to open cover without first removing a master seal or padlock.
13. The design must be readily adaptable to manufacture by drawing or casting.
14. The cost of the enclosure complete as above specified shall be consistently low and reasonable.

OPERATING COMMITTEE MEETING

(*Continued from page 23*)

several States, has gradually risen from 8, 9 and 10 per cent of gross earnings "until some of the companies are paying from 15 to 18 per cent of their gross earnings, and they have not yet felt the result of the measures that the current legislatures have added." He also indicated that if the 3 per cent Federal tax were imposed on the industry it would be equivalent to raising the Federal Income Tax of the companies from 13.75 per cent of net income to approximately 21 per cent.

Mr. Randall LeBoeuf, Jr. appeared before the Committee on behalf of the Niagara Hudson Power Corporation. Mr. W. C. Mullendore represented the Southern California Edison Company. Mr. H. M. Havener of Des Moines, Iowa, represented individual investors in securities of power companies operating in the State of Iowa, Mr. B. Loring Young represented the Massachusetts Utilities Associates, and Mr. Samuel Ferguson represented the Hartford Electric Light Company and the Connecticut Power Company. Mr. Havener's testimony regarding the effect of the tax on the small stockholder was of particular interest.

Copies of the report of the May 2 and 3 hearings on H.R. 5040, which contain the testimony of these representatives, may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

INDUSTRIAL HEATING NEWS

By D. H. GERHARD

Consumers Power Company, Jackson, Mich., Former Chairman, Industrial Heating Committee

ELECTRICALLY HEATED KETTLE FOR VARNISH MAKING

A recent installation of a 10 kw immersion heater has been made in a 40 gallon varnish kettle where a temperature of 180° to 200° F. is required. The installation is unique from the standpoint that an existing fuel-fired steam boiler located some distance from the kettle was disconnected and electricity substituted merely by inserting the electric unit below the kettle and making the connections with insulation on the outside.

The electric unit consists of a 42 inch immersion type element fitted into a standard 3 inch pipe through which water from the jacket of the kettle is circulated. A pressure of possibly 5 lb per square inch is built up and a safety valve is provided against any possible failure in the controls.

Prior to the change, approximately 3 hours were required to produce steam, whereas with the electric unit the same result can be accomplished in about one hour without the labor requirement previously experienced. Because of the intermittent use of the kettle, electric heat is advantageous because heat can be applied immediately without loss of time experienced with the old boiler. The customer reports that the electric installation has paid for itself in less than one year.

SPOT AND SEAM WELDING OF ALUMINUM ALLOYS

The low melting temperature and high conductivity of aluminum alloys make it most difficult to pass sufficient current to weld them without either burning through or badly defacing the surfaces. Still another phase of the problem is the surface oxides that require puncturing before establishing the welding current across the pieces to be jointed. The usual method of make-and-break contacts for current control used on seam welders is not capable of stopping the current in time to successfully weld these alloys.

The Thyratron method of current control is the practical solution of spot and seam welding these alloys most satisfactorily. Synchronous timing of the current is possible to an exact number of cycles on and off, with sufficient flexibility and accuracy of adjustment to suit all requirements.

The power tube hook-up is a simple electrical circuit that operates continuously on a definite job with trouble-free precision. Its use on a given design of seam welder is said to increase production three times over make-and-break controllers. This means that on the usual installation there will be no increase in overhead or labor, but three times the number of welds can be produced, with added kilowatt-hours that are small as compared with the reduction in other costs.

One large maker of aluminum products has developed both seam and spot welding for small and large jobs, installing a 700 kv-a unit. Seam welds are made on sheets from 1/16 in. to 1/8 in. maximum thickness for industrial containers of liquids and gas-tight vessels of various kinds, light metal sections in aircraft construction and I-beams fabricated from two channels placed back to back. Spot welds are made on sheets 1/8 in. to 3/16 in. maximum thickness used in a wide variety of fabrication in making of metal sash, fabricating alloy chairs, tables, etc.

Manufacturers of mild steel, stainless steel, chromium and cadmium plated steel, Terne plate, and duralumin are good prospects for such a cost reducing method of control. Seam welders perhaps come first, with spot and butt welders next in order. Some of these products are steel barrels, drums, one-time metal containers, gasoline supply tanks, domestic water heating tanks, milk cans, auto and truck bodies, fender and bumper jobs, and sections used in aircraft and truck body construction.

OIL REDEMPTION BY ELECTRIC HEAT

The reconditioning of automobile crankcase oil for re-use in motors is now becoming an established practice among progressive fleet operators.

The reclaimer is a compact machine, embodying a complete purification process which is both economical and simple in operation. The oil is first permitted to settle, then passed through an electric still and finally through a series of filters. The equipment requires 2 or 3 kw of heating units and delivers from 2 to 5 gallons of oil per hour.

All companies operating a fleet of busses, trucks, or cars are prospects for these machines.

APPLYING BABBITT TO STEEL

A plant manufacturing bushings has just placed in production, after six months of experimental work, a process for applying babbitt metal to steel strip. The equipment for melting the babbitt, heating the dies, and tinning and preheating the steel strip consists of electric units automatically controlled. Due to the necessity of carefully maintaining fusing temperatures as the babbitt is applied to the strip, very close temperature regulation is necessary.

LIQUID HEATING

A chemical plant needed to maintain the temperature of a liquid as it flowed from one part of the plant to the next process and installed a piece of ascoloy pipe (high resistance) to which was connected a 7.5 kv-a single phase transformer—the neutral being connected to center of pipe and terminals to the ends. This, with thermostat, gave temperature maintenance.

A chemical having a sensitive vaporization point was heated in a vat to a point just below vaporization for processing. To do this properly it was necessary to strap strip heaters outside the jacket of vat—the jacket containing high heat conductivity fluid to give rapid and uniform heat transfer. 30 kw load.

ELECTRIC HEAT IN A SMALL DAIRY

In a small dairy which makes its own buttermilk there is a need for keeping a warming oven or box at a carefully controlled and uniform temperature so that the buttermilk can be placed there during the culturing period. This type of customer is a good prospect for a small heating unit.

HEATING OF LIQUID SOAP

A manufacturer of cement slabs for roofing tile uses liquid soap in lubricating the mold in which the cement is cast. Approximately 4 kw of immersion heating units can be used for heating the liquid soap. This is a rather novel application.

AUTOMATIC SHIRT IRONERS

Automatic shirt ironers in a manufacturing plant have been changed from

steam to electric—with increased production of about five to one due to increased temperature (70° F. more) and the consequent change to full automatic operation.

GLASS ANNEALING

During the past year a manufacturer of glass containers added another electric lehr, making fifteen lehrs in operation with a total installed capacity of 975 kv-a. This manufacturer feels that electric annealing is so satisfactory that there is no comparison with other types of annealing. His breakage due to improper annealing was so markedly reduced that the cost of fuel is not a factor. Not only that, but on the fuel cost basis alone he is more than satisfied as is indicated by operating experience.

NEW USES OF ELECTRICITY IN THE RAISING OF TROPICAL FISH

The fad of raising tropical fish, which is sweeping the country at the present time, offers several new and interesting uses for electricity.

One use is electric heat for maintaining power temperatures. Most tropical fish require an average temperature of 75° F. If the temperature falls much below 70° F., the fish are particularly subject to diseases and cold and may die from a fungus growth which acts similar to pneumonia. For the breeding of tropical fish, the temperature should be increased some and maintained between 80 and 85° F.

Many manufacturers have heaters which they use for this purpose. In most cases, the heater is of the immersion type of from 75 to 100 watts capacity and designed to take care of but one aquarium at a time. A Pittsburgh manufacturer of strip heaters has a good heater of 75 watt capacity that is thermostatically controlled to maintain either 75, 80, or 85° F. It will heat the average aquarium, which will not run much over 20 gallons capacity, very nicely. Most enthusiasts have several aquariums which offer an outlet for many 75 or 100 watt heaters.

As the rarer tropical fish are of considerable value, some enthusiasts prefer to heat their aquariums by control of room temperature, especially during the spring and fall semi-heating seasons.

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CONVENTIONS AND MEETINGS

MAY

2-5 Chamber of Commerce of the U. S. A., Washington, D. C.
10-12 American Institute of Electrical Engineers, Schenectady, N. Y.
10-12 American Mining Congress, Pittsburgh, Pa.
21-25 National Electrical Manufacturers Association, The Homestead, Hot Springs, Va.
25 National Board of Fire Underwriters, New York, N. Y.
29-31 National Fire Protection Association, Hotel Schroeder, Milwaukee, Wis.

JUNE

1 National Fire Protection Association, Hotel Schroeder, Milwaukee, Wis.
5-8 Edison Electric Institute, Palmer House, Chicago, Ill.
4 Electrical Equipment Committee, Palmer House, Chicago, Ill., 10.00 a.m.
5 Power Generation Committee, Palmer House, Chicago, Ill., 2.00 p.m.
5 Transmission and Distribution Committee, Palmer House, Chicago, Ill., 2.00 p.m.
5 Sales Committee, 3.00 p.m., Palmer House, Chicago, Ill.
6 Operating Committee, 3.00 p.m., Palmer House, Chicago, Ill.
5-10 International Chamber of Commerce, Vienna, Austria.
8-10 National Electrical Wholesalers Association, Pacific Division, Del Monte, Cal.
12-15 National Association of Purchasing Agents, Boston, Mass.
14-16 Canadian Electrical Association, The Log Chateau, Lucerne-in-Quebec, Canada.
21-24 American Society of Agricultural Engineers, Lafayette, Ind.
25-30 American Institute of Electrical Engineers, Chicago, Ill.
26-30 American Society for Testing Materials, Chicago, Ill.
26-30 World Power Conference, Section Meeting, Stockholm, Sweden.
26-30 American Society of Civil Engineers, Chicago, Ill.

JULY

1 American Society of Civil Engineers, Chicago, Ill.
1-10 World Power Conference, Sectional Meeting, Stockholm, Sweden.

AUGUST

28-31 Illuminating Engineering Society, Delevan, Wis.

SEPTEMBER

4-8 American Institute of Electrical Engineers, Pacific Coast Meeting, Salt Lake City, Utah.
18-20 American Transit Association, The Stevens Hotel, Chicago, Ill.
25-29 American Gas Association, Chicago, Ill.

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